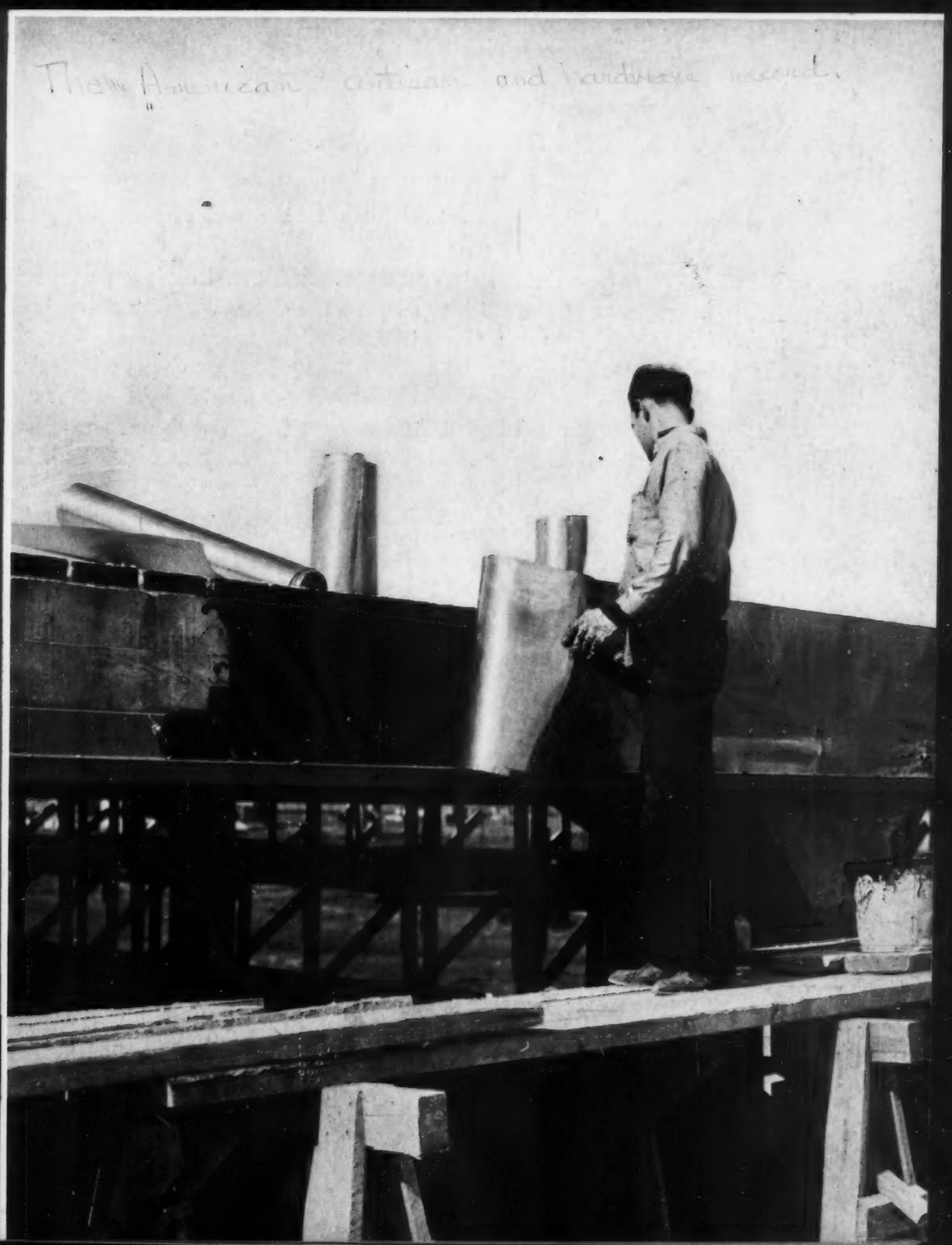
AMERICAN ARTISAN

WARM AIR HEATING • AIR CONDITIONING
SHEET METAL CONTRACTING



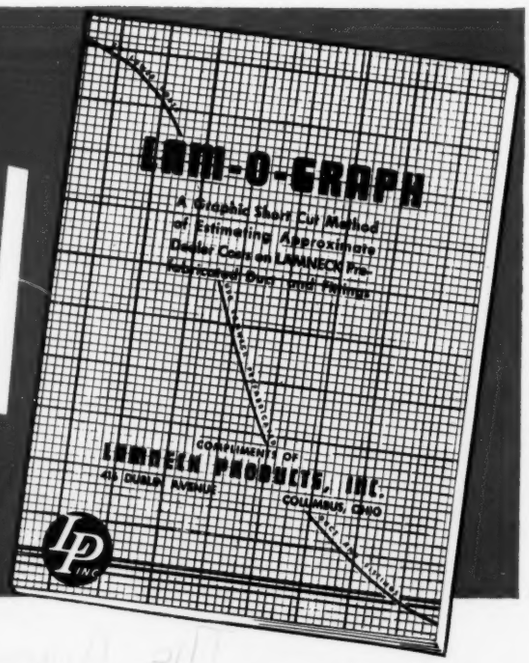
AIR CONDITIONING SECTION
PAGE 43

STABLISHED
8 8 0

JULY
1938

TS200
.A7

LAM-O-GRAPH


LAM-O-GRAPH
A Graphic Short Cut Method of Estimating Approximate Dealer Costs on LAMNECK Pre-Fabricated Duct and Fittings
COMPLIMENTS OF
LAMNECK PRODUCTS, INC.
414 DUBLIN AVENUE
COLUMBUS, OHIO
LP INC

Still Another Valuable Service Feature for Users of LAMNECK PREFABRICATED DUCT

LAMNECK'S responsibility to its customers goes far beyond the furnishing of products of highest quality. It also embraces the development of service features that materially aid dealers, jobbers and manufacturers in the sale and use of Lamneck Simplified Prefabricated Duct.

The latest important service feature produced by Lamneck is Lam-O-Graph, an easy short-cut method of estimating dealer costs on Lamneck Prefabricated Duct and Fittings required for a residence air conditioning installation.

Lam-O-Graph is an ingenious set of simple charts whereby a reasonably accurate preliminary price may be secured immediately without tedious calculation or loss of time. This quick method is not an exact engineering formula nor does it take the place of the Easy Take-Off Pad. However, it serves to give you an approximate price "on the spot," when quick action is necessary.

The saving of time and labor made possible by Lam-O-Graph is a revelation. We'll gladly furnish this practical sales aid free of charge. Write at once for your copy.

LEADERS FOR 21 YEARS IN FURNACE PIPE, FITTINGS AND REGISTERS
LEADERS FOR 4 YEARS IN PREFABRICATED DUCT

LP INC

LAMNECK PRODUCTS, INC.

414 DUBLIN AVENUE • COLUMBUS, OHIO

PREFABRICATED DUCT AND FITTINGS FOR ALL TYPES OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS

EMcN. 3/10/29

Workability Assured with Ryerson Sheets

● All Ryerson sheets (there are more than 25 different kinds) are of uniform high quality and assure excellent workability. They are all prime quality, carefully selected for finish, flatness, gauge and size accuracy. No seconds are ever carried.

Sheets are but one unit of the wide range of Ryerson Certified Steel products carried in stock for Immediate Shipment. There is hardly a product in the finished steel and allied lines—bars, angles, channels, bands, tees, etc. — that you cannot secure at once from these large and complete stocks. Concentrate your steel requirements with one reliable source and save office work, time, trouble and money. If you do not have the current Ryerson Stock List, we will gladly send it.

JOSEPH T. RYERSON & SON, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON *Certified* STEELS

RYERSON SHEETS INCLUDE:

Allegheny Stainless	Galvanized	Stretcher Levelled
Blue Annealed	Panel and Sign	Uniform Blue
Copper Alloy	Galvannealed	Vitreous Enameling
Corrugated	Heavy Hot Rolled	Wellsville Polished
Deep Drawing	Long Terne	and Many Others

EMen. 3/10/29

In This Issue

THIS month's cover photograph (furnished by American Brass Co.) shows application of Copper Armored Sisalkraft on a new building for the Coca-Cola Co., Kearny, N. J. An article on page 24 describes some of the interesting applications of light weight copper sheets.

★

The training of apprentices is attracting the attention of a large number of thoughtful contractors. Exactly how an apprentice should be schooled seems open to some argument. On page 28 we publish a list of school subjects and the apprenticeship agreement adopted for the city of Cleveland, Ohio.

★

The mid-year meeting of the National Warm Air association in Milwaukee was more than usually interesting. The reports of the Research Residence staff covering stoker firing, limit control lag, pressure losses in changes in section brought forth very practical information. And the buffet supper and entertainment furnished by the Mueller Furnace Co. will linger long in the memories of all who attended. On page 32 we report the convention.

★

During the last three or four years we have paid increasing attention to the problems of welding in the sheet metal shop. Of all the articles published, none, to our way of thinking, has quite the plain, every-day advice offered in the article which begins on page 40. E. I. Larsen, the author, has given the reasons why certain shop practices give good results while others —not much different—bring failure.

★

On page 45 we publish part 1 of the report from the Research Residence on summer cooling using a condensing unit 40 per cent undersized by previous calculations. This series of tests is important, we believe, because the results open up a completely new field in residence cooling.

★

Words beyond count have been written on night air cooling (attic ventilation) but how to install a system so that noise, vibration and service are eliminated has been pretty much of a personal mystery. We attempt to cover some of the requirements for a satisfactory installation on page 54.

★

And G. A. Voorhees continues his Precalculated Engineering series on page 57 with a discussion of selecting the proper furnace size. Very important is his method for rating a furnace when converted from gravity to mechanical circulation, knowing only the square inches of leader pipe rating.

AMERICAN ARTISAN

With which is merged

FURNACES AND SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

A. A. Kennedy, Assistant Editor — Brewster S. Beach, Consulting Editor

Vol. 107, No. 7 — July, 1938 — Founded 1880

CONTENTS

Sales Mean Jobs 23
New Applications of Light Weight Sheet Copper 24
Arnold Kruckman's Washington Letter 27
Cleveland's Plan of Apprenticeship Training 28
Shop Fabricated Pop Corn Machine 31
The National Warm Air Convention 32
A Low-Cost, All-Steel House 36
The Problem Corner 38
Welding Ferrous and Non-Ferrous Sheet Metals 40
Pennsylvania Contractors Reorganize Ass'n 67
Sioux City, Iowa, Furnace Ordinance 69
New Products 71
With the Manufacturers 82
News Items 86
New Literature 90

THE AIR CONDITIONING SECTION

Study of Summer Cooling in Research Residence 45
Attic Fan Installation Practices 54
G. A. Voorhees Precalculated Engineering 57
Characteristics of Air Borne Particles 62

Member of Audit Bureau of Circulations—Member Associated Business Papers, Inc.

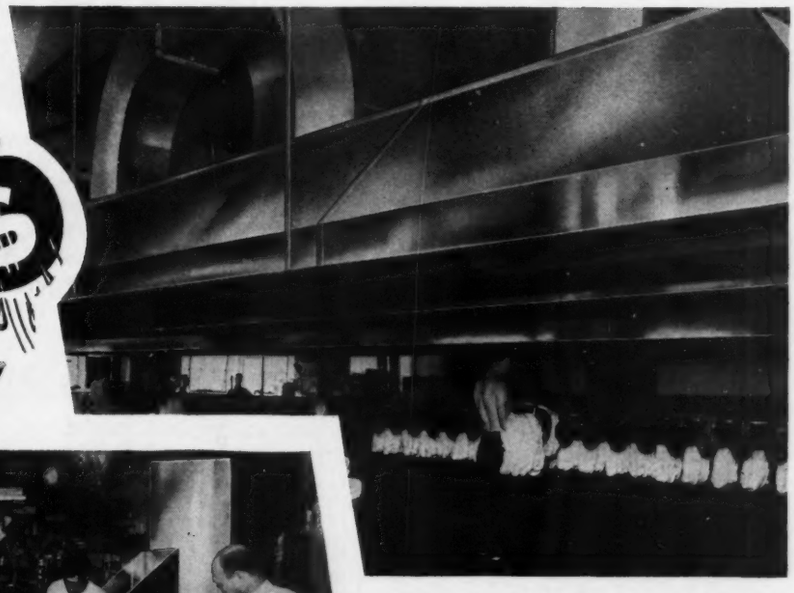
Published monthly by Keeney Publishing Company, 6 North Michian Ave., Chicago. Branch Offices—In New York, Room 1734, Grand Central Terminal Building, Murray Hill 2-8293; In Cleveland, 2128 Rossmoor Road, Cleveland Heights, Yellowstone 1540; In Los Angeles, J. H. Tinkham, 1406 S. Grand Ave., Richmond 6191.

Copyright 1938 by Keeney Publishing Company—F. P. Keeney, President; W. J. Osborn, Vice President; R. Payne Wettstein, Secretary; Chas. E. Price, Treasurer. Advertising staff: Wallace J. Osborn, R. Payne Wettstein, Robert A. Jack, J. H. Tinkham, L. A. Doyle.

Yearly Subscription Price—U. S. and possessions, Canada, Mexico, South America, Central America, $2.00; Foreign, $4.00. Single copies, U. S. and possessions, $.25. Back numbers, $.50. January, 1938, Directory issue, $1.00 per copy. Entered as second-class matter, July 29, 1932, at the post office at Chicago, Illinois, under the act of March 3, 1879.

More than 8,000 Copies of this Issue are being distributed

LAND BIG-MONEY JOBS ...by SELLING MONEL



These Monel hoods and ducts in the plant of Malina and Co., New York, N. Y. replaced galvanized iron which failed because of rust and corrosion. The completed job takes about 5 tons of Monel sheet.

• • •

Monel fume ducts in process of fabrication at the plant of Benj. Low, sheet metal contractor, 523 E. 13th St., New York, N. Y. They are constructed of .021 and .031 gauge Monel sheet, lock seamed and soft soldered.

This ONE dyehouse job alone uses FIVE TONS of Monel sheet

What a sweet job for any sheet metal contractor! These hoods and ducts, when completed, take *five tons* of Monel sheet.

Are you landing jobs like this? You can. By building a reputation for working in Monel, you can land jobs like this... plus scores of other jobs that are smaller yet just as profitable.

What's the *secret* in landing this class of work? The secret is this. Whenever you stop in at a dyehouse or textile plant remember *two simple things:*

1. Rusty equipment in a dye room means spoiled goods . . . *lost profits* for the owner.
2. Monel for such equipment means the end of rust . . . *permanently* because Monel cannot rust.

So here's your chance: Dyehouse operators and textile plant executives know that it *pays* to replace rusting equipment. *Tell them you handle Monel . . . and suggest this rust-proof, corrosion-resistant metal for vats, tanks, tank linings, buckets, pans and other utensils.*

All of this equipment, and numerous other items, offer you an opportunity to *sell your work.*

Tough, strong and durable as Monel is, it can readily be fabricated by all of the usual methods, including welding. Write for further information and complete working instructions. Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York, N. Y.

"Monel" is a registered trade-mark of The International Nickel Company, Inc., which is applied to a nickel alloy containing approximately two-thirds nickel and one-third copper.

The presence of The Anthracite Industries, Inc., Seal of Approval on heating equipment indicates satisfactory performance in a series of exhaustive, unbiased tests, using Pennsylvania Anthracite. This symbol is a dependable buying guide in the selection of modern anthracite heating equipment.

BOILERS*

ARCO No. 7 IDEAL BOILER
American Radiator Co., 40 W. 40th St., N. Y. C.

BURNHAM ANTHRA-HEAT UNIT (Magazine Feed). Burnham Boiler Corp., Irvington, N. Y.

FITZGIBBONS ANTHRA-HEAT BOILER (Magazine), and "COAL-EIGHTY" (Stoker-fired). Fitzgibbons Boiler Co., Inc., N. Y. C.

INTERNATIONAL STOKER-BOILER (Stoker-fired). International Boiler Works, E. Stroudsburg, Pa.

KEWANEE ROUND TYPE R BOILER
Kewanee Boiler Corp., Kewanee, Ill.

NEWPORT (Magazine Feed)
Richardson & Boynton, New York

PEERLESS TYPE EB BOILER. Peerless Heater Div., Eastern Foundry Co., Boyertown, Pa.

SPENCER (Magazine Feed). SPENCER STEEL STOKER BOILER (Stoker-fired). Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.

WEIL-McLAIN (Magazine Feed)
Weil-McLain Co., Michigan City, Ind.

WARM AIR FURNACES*

ALLIS-CHALMERS UNIVERSAL HEATER (Magazine Feed Type)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FITZGIBBONS DIRECTAIRE (Approved for stoker-firing only).
Fitzgibbons Boiler Co., Inc., N. Y. C.

FOX SUNBEAM FURNACE (Stoker-Fired)
Fox Furnace Co., Elyria, Ohio

KELSEY WARM AIR GENERATOR (Approved for stoker firing only).
Kelsey Heating Co., Syracuse, N. Y.

MUELLER STEEL WARM AIR FURNACE
L. J. Mueller Furnace Co., Milwaukee, Wis.

SPEAR WARM AIR DISTRIBUTOR (Approved for stoker firing only). James Spear Stove & Heater Co., 1823 Market St., Philadelphia, Pa.

WATERMAN WATERBURY AIR CONDITIONER. (Approved for stoker firing only.)
Waterman Waterbury Co., Minneapolis, Minn.

**Any of the boiler or warm air furnace manufacturers listed above will furnish complete information on winter anthracite air-conditioning.*

AUTOMATIC ANTHRACITE STOKERS

AUTOCOAL ANTHRACITE STOKER
Crane Co., 836 S. Michigan Ave., Chicago, Ill.

COOPER. Cooper & Cooper, Inc.,
37 Fenn St., Pittsfield, Mass.

D & E AUTOMATIC ANTHRACITE BURNERS
Dickson & Eddy, 17 Battery Place, N. Y. C.

ELECTRIC FURNACE-MAN
Electric Furnace-Man, Inc., 7 Dey St., N. Y. C.

FAIRBANKS-MORSE (Hopper Feed Only). Fairbanks, Morse & Co., 900 S. Wabash Av., Chicago.

FLYNN & EMRICH ANTHRACITE STOKER
Flynn & Emrich Co., Baltimore, Md.

FREDERICK ANTHRACITE BURNER
Frederick Iron & Steel Co., Frederick, Md.

FREED
Freed Heater & Mfg. Co., Collegeville, Pa.

FUEL SAVERS
Fuel Savers, Inc., 15 & Herr Sts., Harrisburg, Pa.

GENERAL STOKER
General Stokers, Inc., Broad St. Station, Phila.

GILKOAL
Catskill Metal Works, Catskill, N. Y.

HERCULES ANTHRACITE BURNER
Sears, Roebuck & Co., Chicago, Ill.

HOLLAND ANTHRACITE STOKER
Holland Furnace Co., Holland, Mich.

IRON FIREMAN. Iron Fireman Mfg. Co., 420 Lexington Ave., N. Y. C.

LINK-BELT (Hopper Feed Only). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

MASTER ANTHRACITE STOKER
Muncie Gear Works, Inc., Muncie, Ind.

MOTORSTOKOR
Hershey Machine & Foundry Co., Manheim, Pa.

NEWTON STOKERS. Newton Supply Co., 53rd & Baltimore Ave., Philadelphia, Pa.

SKELLY
Combustion Engr. Co., 60 E. 42nd St., N. Y. C.

STOKOL
Schwitzer-Cummins Co., Indianapolis, Ind.

VULCAN
Vulcan Anthracite Stoker Co., Wilkes-Barre, Pa.

BURNER BOILER UNITS

IMP. V. M. Cruikshank Utilities, 18 S. 7th St., Sunbury, Pa.

WESTINGHOUSE. Westinghouse Electric Co., 3001 Walnut St., Philadelphia, Pa.

THERMOSTATIC CONTROLS

AFCO ALL-ELECTRIC HEAT REGULATOR
Atlas Foundry Co., Irvington, N. J.

CHANDLER HEAT REGULATOR
Cleveland Steel Products Co., Wellington, Ohio

COOK HEAT CONTROL
Cook Electric Co., 2700 Southport Ave., Chicago

DETROIT ROOM THERMOSTAT. Detroit Lubricator Co., 5900 Trumbull Ave., Detroit

ELECTRIC JANITOR. Minneapolis-Honeywell Regulator Corp., Minneapolis, Minn.

GLEASON-AVERY ELEC. TEMP. REGULATORS
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.

MASTER HEAT REGULATOR. White Mfg. Co., 2362 University Ave., St. Paul, Minn.

MERCOID CONTROLS
Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.

MINNEAPOLIS-HONEYWELL CONTROLS
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

PENN TEMTROL
Penn Electric Switch Co., Goshen, Ind.

PERFEX CONTROLS. Perfex Controls Co., 915 W. Oklahoma Place, Milwaukee, Wis.

PIONEER HEAT REGULATORS. Pioneer Heat Reg. Div., Master Electric Co., Dayton, Ohio

RUSSELL "HOLD-HEET" THERMOSTAT
Russell Electric Co., 340 W. Huron St., Chicago

SHEER HEAT REGULATORS
H. M. Sheer Co., Quincy, Ill.

THRUSH RADIANT HEAT CONTROL
H. A. Thrush & Co., Peru, Ind.

UNITED CONTROLS No. 11 THERMOSTAT
United Electric Controls Co., Boston, Mass.

CONTROLS FOR TANK HEATERS

(Domestic Hot Water Supply)

ANTHRACITE HOT WATER REGULATOR & 'BLUE COAL' HOT WATER REGULATOR
D. L. & W. Coal Co., 120 Broadway, N. Y. C.

DEEGAN No. 122 REGULATOR.
Deegan Regulator Co., 725 E. 135th St., N.Y.C.

JAMES REGULATOR. James Regulator Co., 382 Peacock St., Pottsville, Pa.

METAPHRAM H-3 REGULATOR
National Reg. Div., Minn.-Honeywell Reg. Co., 2301 Knox Ave., Chicago, Ill.

SYLPHON REGULATOR
Fulton Sylphon Co., Knoxville, Tenn.

SERVICE WATER HEATING EQUIPMENT

(Domestic Hot Water Supply)

Tank Heaters*

BENGAL (Magazine Feed Type)
Floyd-Wells Co., Royersford, Pa.

FREED (Magazine Feed Type)
Freed Heater & Mfg. Co., Collegeville, Pa.

PEERLESS (Magazine Feed Type). Peerless Htr. Div., Eastern Foundry Co., Boyertown, Pa.

ELECTRIC FURNACE-MAN (Stoker-fired for large installations)
Electric Furnace-Man, Inc., 7 Dey St., N. Y. C.

SPENCER HEATERS
Spencer Heater, Williamsport, Pa.

**In addition to these specialized heaters, there are a number of standard tank heaters available through various plumbing supply houses. When equipped with an Approved Control and a proper sized tank, these units give remarkable satisfaction and economy with Anthracite.*

INDIRECT HEATERS

B & G
Bell & Gossett Co., 3000 Wallace St., Chicago

EXCELSO. Excelso Products Co., 65 Clyde Ave., Buffalo, N. Y.

PARACOIL. Davis Engineering Corp., 1058-72 E. Grand Ave., Elizabeth, N. J.

TACO
Taco Heaters, Inc., 342 Madison Ave., N. Y. C.

KITCHEN RANGES

AGA STOVE
Aga Stove Co., 500 Fifth Ave., N. Y. C.

DUTCH OVEN KITCHEN RANGE
Globe Stove & Range Co., Kokomo, Ind.

JEDDO-HIGHLAND HEATERANGE
Heaterange Corp., Jeddo, Pa.

KOL-AX RANGE
Kol-Ax Co., Inc. Stroudsburg, Pa.

NEW YORK FRENCH RANGE. New York French Range Co., 188 Chambers St., N. Y. C.

SPACE HEATERS

BRILLIANT MONOGRAM BASE BURNER
Quincy Mfg. Co., Quincy, Ill.

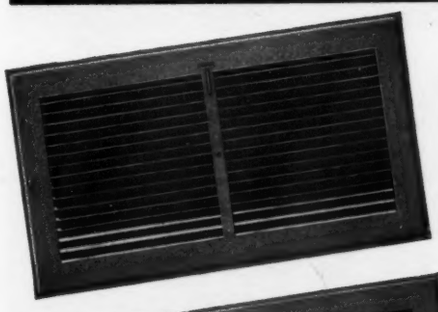
GLOW BOY PARLOR HEATER
Globe Stove & Range Co., Kokomo, Ind.

RENOWN
Renown Stove Co., Owosso, Mich.

ESTATE HEATROLA
Estate Stove Co., Hamilton, Ohio

ANTHRACITE INDUSTRIES, INC., Chrysler Bldg., New York

U.S. Air-Conditioning Register FLEXIBILITY



UP to 60° For Cooling or ANY ANGLE For Warmth

... and NOW the

U.S. ADJUSTABLE-BAR REGISTER Comes with the NEW INSET PANELS FOR A "UNIVERSAL" FLOW!

HERE'S HOW IT WORKS

Showing the ease with which Panels are Snapped into Stops, at back of registers, which renders Panels Vibrationless.

There's never been anything like it before. With this one U. S. Adjustable-Bar Register plus Inset Panels and Setting Frames you can complete all air-conditioning installations, and eliminate all the need and expense of carrying a wide variety of directional flow registers.

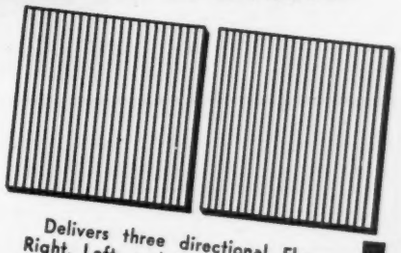
To the new U. S. Adjustable-Bar Air-Conditioning Register announced this year (shown above) are added the new U. S. Inset Panels which produce all directional flows:

1—Left and Right-Flow, Up, Straight, or Down-Flow.

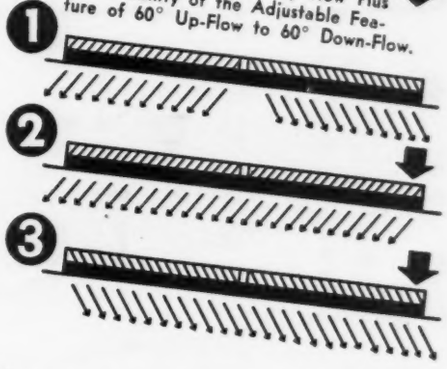
2—Left-Flow, Up, Straight, or Down-Flow.

3 — Right-Flow, Up, Straight, or Down-Flow.

Register without panels delivers 60° Up-Flow to 60° Down-Flow.



Delivers three directional Flows—Right, Left, and Two-Way Flow Plus the Flexibility of the Adjustable Feature of 60° Up-Flow to 60° Down-Flow.



Write for complete information and prices on U. S. Adjustable-Bar Registers with or without Inset Panels and U. S. Louver Type Air-Conditioning Registers with or without Inset Panels.

US

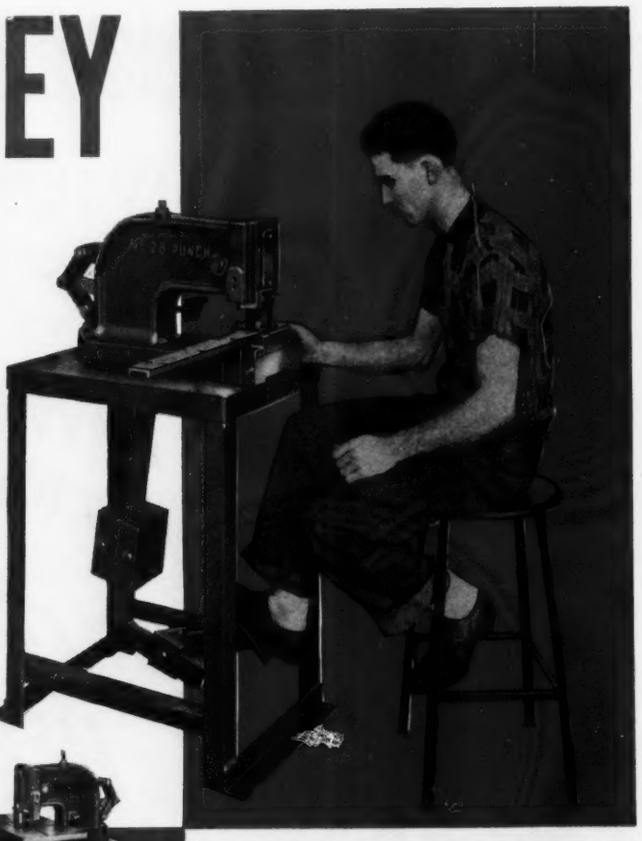
UNITED STATES REGISTER CO.

BATTLE CREEK, MICHIGAN

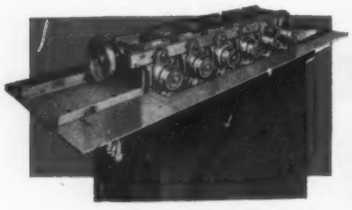
MINNEAPOLIS • KANSAS CITY • ALBANY • SAN FRANCISCO • NEW YORK, N. Y.

SAVE MONEY

A New Way of Making DRIVE CLEATS



NOTCH Notch strips on Whitney-JENSEN Kick Press equipped with special notching punch and die. Set stops to notch for Drive Cleats of desired standard lengths.

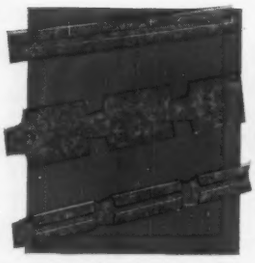


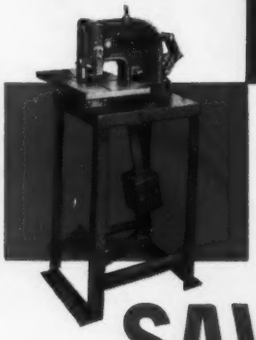
ROLL Put notched blanks through Whitney-JENSEN No. 75 Duplex Rolling Machine to fold edges. Special rolls make accurate, straight cleats with open ends. Store completed strips of cleats until needed for delivery to job.

This is a conventional folded Drive Cleat strip. It has to be sheared to length, the ends pried open and snipped out with shears.

This is the new Drive Cleat blank as it comes from the notching press. Notches are beveled off to form easy-entering end.

The Drive Cleat blank after rolling. Snip off a cleat (only one thickness to cut) and it's ready to use. Open ends, straight sides, accurate, uniform.



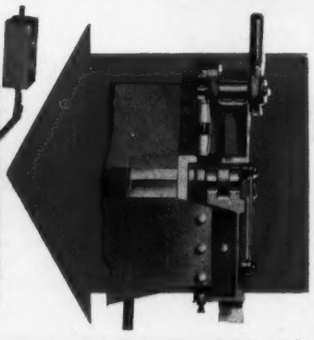


LARGE WORK TABLE MACHINE Large steel table is slotted to permit wider range of positions for gauges. Available as an accessory on standard Whitney-JENSEN Kick Presses.

SAVE 89% OF LABOR COST

The labor cost of making Drive Cleats by the above method is about 20c per 100 lbs. as compared with about $1.80 per 100 lbs. the ordinary way—a saving of 89%! In addition—better, straighter, more uniform Drive Cleats, loss and scrap eliminated entirely.

SAVE YOUR STRENGTH



*With the New Whitney-*JENSEN ROLLER-BEARING BENDING BRAKE

One of the greatest improvements ever offered since the modern style Brake was developed. Needle-type roller bearings in the apron supports, at the upper end of the toggles, and on the eccentric shafts, eliminate all the major operating frictions on the machine. Tests show great reduction in effort required to handle Brake operations. Speeds up work, reduces fatigue, with no loss of accuracy or power. Save your strength with this new anti-friction brake!

12%—90% LESS EFFORT

Comparative tests with a similar Brake equipped with plain bearings show 12%—14% less force required to swing the apron in making a bend, 32% less force required to press down seams, and 90% less force required to release the clamping handle from over-center position. Only the new Whitney-JENSEN Roller Bearing Bending Brake offers these great savings!

WRITE FOR CIRCULARS

New circulars just off the press describe the important details of the new Roller Bearing Bending Brake and the new Kick Press table. Write for them —or ask your Whitney-JENSEN dealer.

WHITNEY METAL TOOL COMPANY - 91 Forbes St., Rockford, Ill.

I prove it to them with SUPERFEX Model 100-E"

● *You, too,* will find increased volume and profit in the expanding small homes market being stimulated by FHA insured building and modernization loans. *Don't let this opportunity slip through your fingers!*

In the Model 100-E, SUPERFEX offers you a complete warm air conditioning unit — *built* and *priced* for small homes—and *proved* in thousands of small home installations.

Instead of the old "off and on" system, all SUPERFEX models operate under synchronized "high-low" control of burner and blower—as recommended by leading engineers. Air circulates continuously, providing *24-hour air conditioning*—not just the average 8. Because temperature gradient between floor and ceiling is greatly reduced, SUPERFEX ends "LEG-ZONE" discomfort. SUPERFEX owners get all the advantages of automatic oil heat and warm air conditioning with surprising fuel economy.

Dealers, architects, owners—all say SUPERFEX has the right idea. *Investigate now!* Three quiet-running models with capacities at the registers from 65,000 to 140,000 B.t.u.'s. For the complete SUPERFEX sales story, *tear out and mail the coupon below.*

Get this FREE booklet

Describes the modern SUPERFEX method of warm air conditioning. Pictures all models. Gives specifications. Contains valuable heating tips every dealer should have. *Sent FREE on receipt of coupon.*

SUPERFEX

The Mark Of Quality

OIL BURNING

AIR CONDITIONING FURNACE

PERFECTION STOVE COMPANY
7900-G Platt Avenue, Cleveland, Ohio

Send along your free book describing SUPERFEX Air Conditioning Furnaces.

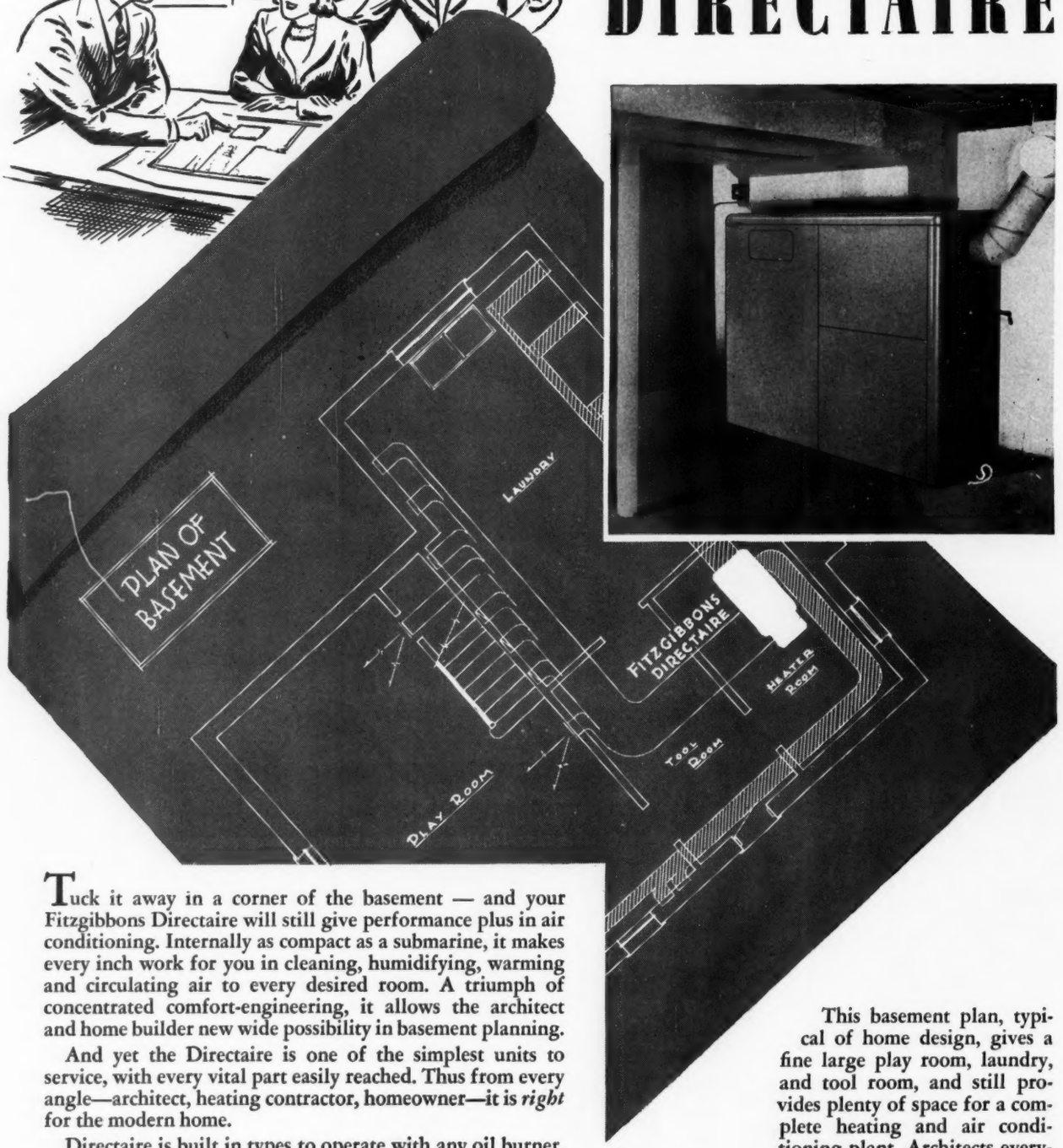
Name_____

Street_____

City_____ State_____

DEALERS! SELL BASEMENT SPACE SAVING with the

FITZGIBBONS DIRECTAIRE



Tuck it away in a corner of the basement — and your Fitzgibbons Directaire will still give performance plus in air conditioning. Internally as compact as a submarine, it makes every inch work for you in cleaning, humidifying, warming and circulating air to every desired room. A triumph of concentrated comfort-engineering, it allows the architect and home builder new wide possibility in basement planning.

And yet the Directaire is one of the simplest units to service, with every vital part easily reached. Thus from every angle—architect, heating contractor, homeowner—it is *right* for the modern home.

Directaire is built in types to operate with any oil burner, gas burner, stoker. Two types of jacket—Enclosing (covering burner) and Standard (shown in photo above).

This basement plan, typical of home design, gives a fine large play room, laundry, and tool room, and still provides plenty of space for a complete heating and air conditioning plant. Architects everywhere have expressed deep interest in Directaire details covered in the catalog. Write us for your copy.

Fitzgibbons Boiler Company, Inc.

General Offices:
ARCHITECTS BUILDING, 101 PARK AVE., NEW YORK, N. Y.
Works: Oswego, N. Y. *Branches and Representatives in Principal Cities*
Distributed in Canada by
FESS OIL BURNERS OF CANADA, LTD., Toronto, Ontario; Montreal, Quebec

DON'T WAIT FOR THE BUILDING BOOM!

For every new home that is built, there are six furnaces that need replacing

Sure you want all the new building business that you can get. But because so much has been made of this market, some of us are inclined to let it overshadow the largest market there is—the replacement market. It may sound unbelievable, but the facts show that one out of every four warm-air furnaces in your community should be replaced. Now is the time to hammer away at these prospects—phone calls, personal calls, post cards, every form of proven sales method there is will bring you results in actual orders. If you handle a unit equipped with Owens-Illinois DUST-STOP Replacement-Type Filters (most manufacturers use them) you have a decided advantage because the public knows through national advertising all about their high efficiency and low cost. Write for complete information about the year-after-year profits that dealers are making on both original and replacement sales of DUST-STOP Air Filters. Use the coupon.

● **DUST-STOP Replacement-Type Air Filters manufactured by Owens-Illinois Glass Company... world's largest manufacturer of glass containers. Also producers of INSULUX Glass Block, FIBERGLAS Insulating Wool, Insulating Blankets and Electrical Insulation.**

Owens-Illinois Glass Company, Toledo, Ohio.

OWENS-ILLINOIS

DUSTOP

REPLACEMENT-TYPE

AIR FILTERS

OWENS-ILLINOIS GLASS COMPANY
Industrial and Structural Products Division
302 Madison Avenue, Toledo, Ohio

Please send, without obligation, all the facts about DUST-STOP Replacement-Type Air Filters.

Name _____

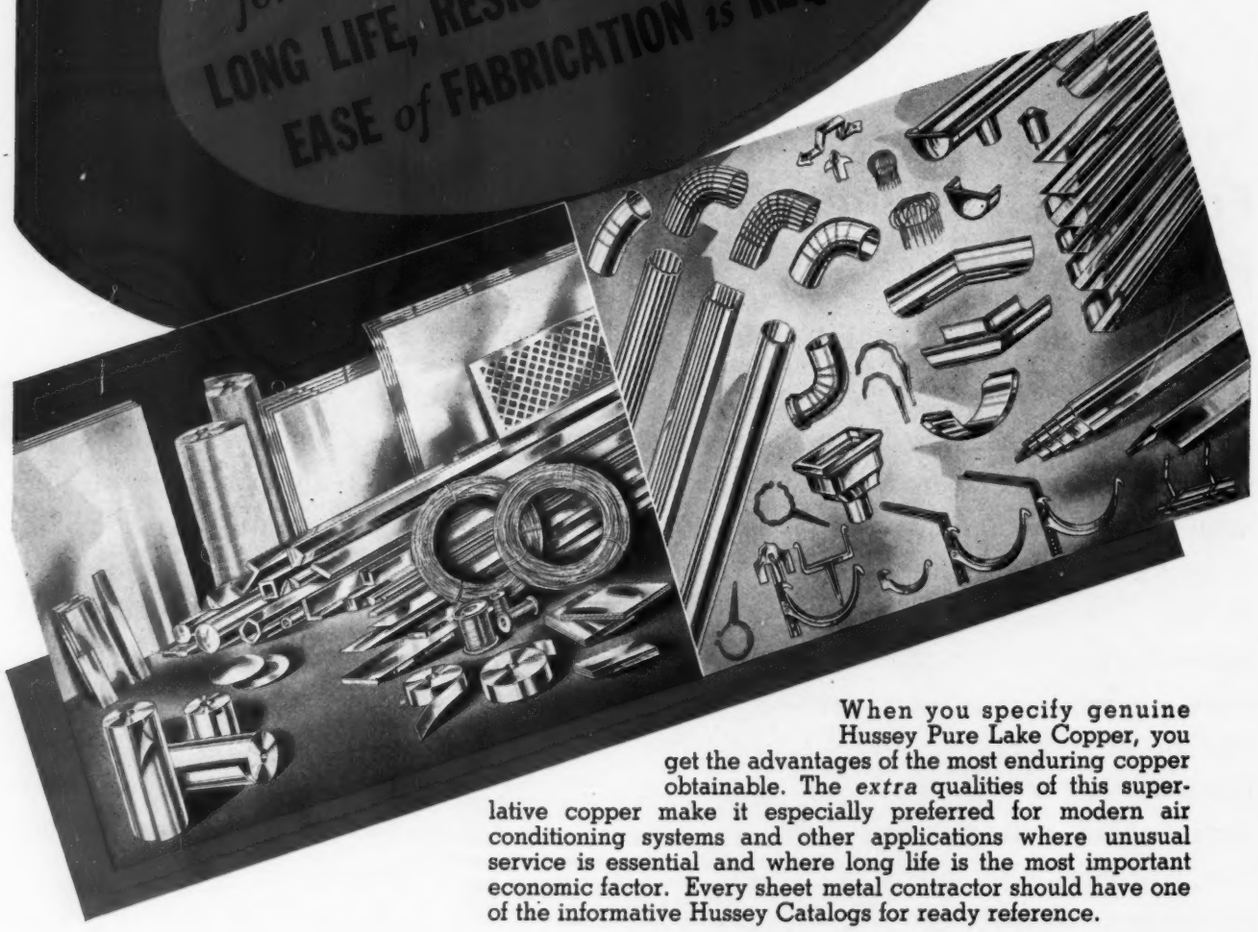
Address _____

City _____ County _____

State _____

HUSSEY COPPER

THE LOGICAL MATERIAL
for all SHEET METAL WORK *where*
LONG LIFE, RESISTANCE *to* CORROSION,
EASE *of* FABRICATION *is* REQUIRED



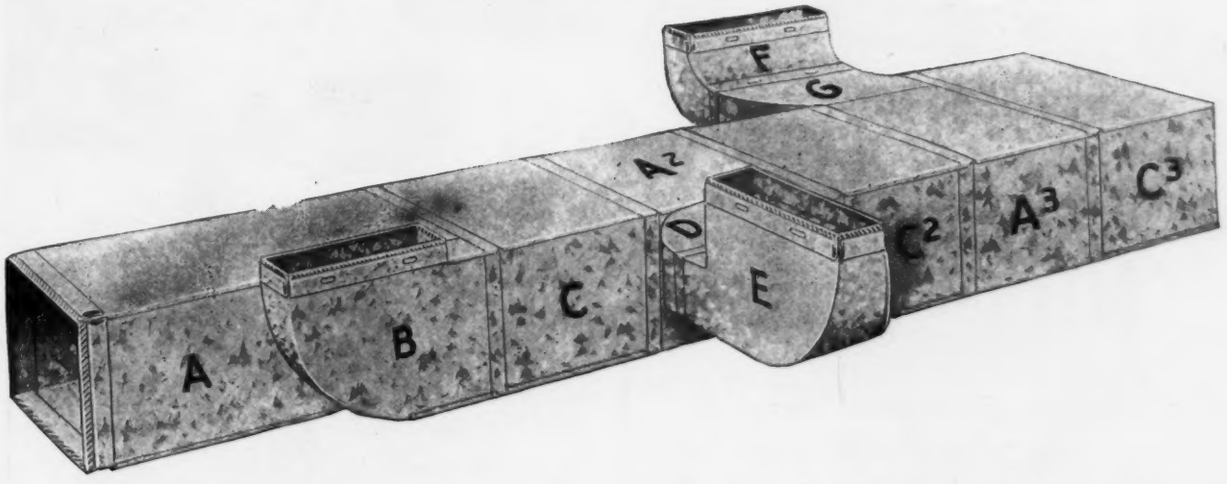
When you specify genuine Hussey Pure Lake Copper, you get the advantages of the most enduring copper obtainable. The *extra* qualities of this superlative copper make it especially preferred for modern air conditioning systems and other applications where unusual service is essential and where long life is the most important economic factor. Every sheet metal contractor should have one of the informative Hussey Catalogs for ready reference.

C. G. HUSSEY & COMPANY
(DIVISION OF COPPER RANGE CO.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouse Stocks in the Principal Cities

Copper **HUSSEY** Brass

F. MEYER & BRO. CO.'S "HANDY"

Pre-Fabricated Duct Work Fits Better, Performs Better and Saves You Money—



This partial assembly shows only a few of the complete line of fittings—fittings that are engineered to direct and facilitate the flow of air to utmost advantage.

Every section and elbow is correctly designed—and every section LOCKS to its neighbors and "stays put." This means faster work and minimum costs. Materials and workmanship are up to the standards maintained for over 70 years.

Sections A, A-2 and A-3 are sections of our newly-perfected duct work. Section B is our new No. G-290 Elbow. Sections C, C-2 and C-3 are two-way "splitters." Sections D and E are No. G-23 reverse elbows. Section F is our new G-16 elbow, and Section G is our G-24 reverse elbow.

If your duct-work information doesn't include our new Duct-work catalogue supplement —it isn't up to date—and you should write for a copy AT ONCE.

PUT YOURSELF IN A POSITION TO PROFIT FROM THE NEW FEDERAL SPENDING-LENDING THAT IS PLANNED TO ENCOURAGE BUILDING.

F. Meyer & Bro. Co.
Peoria, Ill.

F. Meyer & Bro. Co. Peoria, Ill.
Please send full details of your prefabricated duct-work.
(Sign below or clip to your letterhead.)

INDEPENDENT "FABRIKATED" MARCHES ON

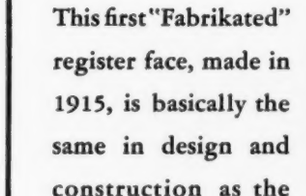
● The superiority of "Fabrikated" was quickly and conclusively demonstrated when first placed on the market in 1915. Floor registers and cold air faces of "Fabrikated" construction gained immediate acceptance because they scored a great advance in strength, appearance and larger open area.

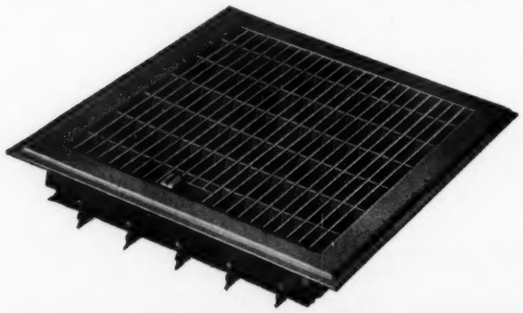
Independent has consistently progressed in making refinements and improvements, to the end that today Independent "Fabrikated" Registers and Cold Air Faces continue to lead in popularity. Specify Independent "Fabrikated" and you can be assured the installation will present the finest appearance and give complete register satisfaction.

Write for Catalogs

THE INDEPENDENT REGISTER CO.
3741 East 93rd Street • Cleveland, Ohio

This first "Fabrikated" register face, made in 1915, is basically the same in design and construction as the "Fabrikated" registers and grilles of today. The "Fabrikated" close mesh register shown below, presents finer appearance because of lower visibility through openings, and excels in strength and rigidity.



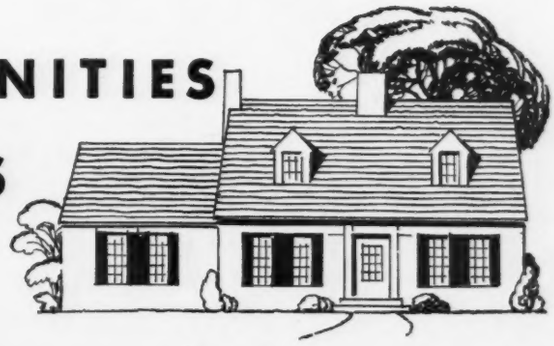


738

INDEPENDENT "Fabrikated" (REG. U. S. PAT. OFF.)

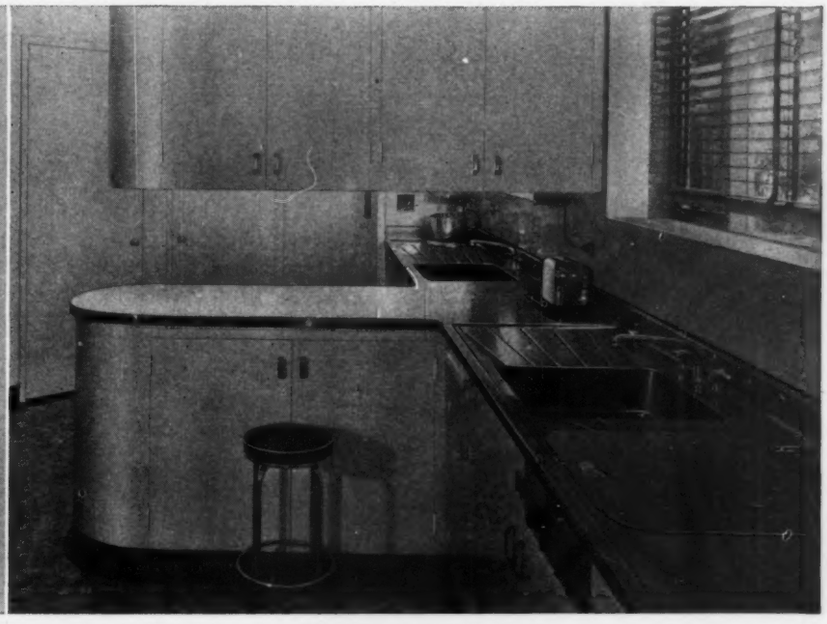
FLOOR REGISTERS AND COLD AIR FACES
AND AIR CONDITIONING REGISTERS AND GRILLES

BIG OPPORTUNITIES IN SMALL HOMES



for sheet metal workers to get more business with **U·S·S STAINLESS STEEL**

NEW IDEA FOR STAIRWAYS, *handrails of U·S·S Stainless Steel lend a permanent touch of modern dignity. By Herman Obrikat Art Metalcraft Studio, Los Angeles.*



THE FABRICATOR'S BEST ADVERTISEMENT *is an installation like this! No one can enter this kitchen without admiring the clean, attractive sparkle of U·S·S Stainless Steel and the workmanship of Modern Metals Manufacturing Company, of Los Angeles, the fabricator. Alert sheet metal workers will find plenty of opportunities for business of this kind.*

SMALL homes are stealing today's construction show. Everywhere, interest in moderate-cost housing units is growing by leaps and bounds, and there is every indication that this activity will continue to increase.

Naturally, any increase in small home construction means more business available for you. But are you making the most of the opportunity?

Stainless steel offers you an intensely modern, practical medium for netting a larger share of the business which will be placed in this field. Architects and builders alike are fully aware of the attractiveness and permanence of stainless steel as applied, for example, in kitchen design.

Because of the metal's universal popularity, installations of stainless steel are easy to sell. For it is the only commercial metal known that keeps its brilliant finish without tedious polishing, without waxing, without lacquering . . . the only metal that can give your customers the assurance they want of homes that will retain indefinitely their brand-new sparkle.

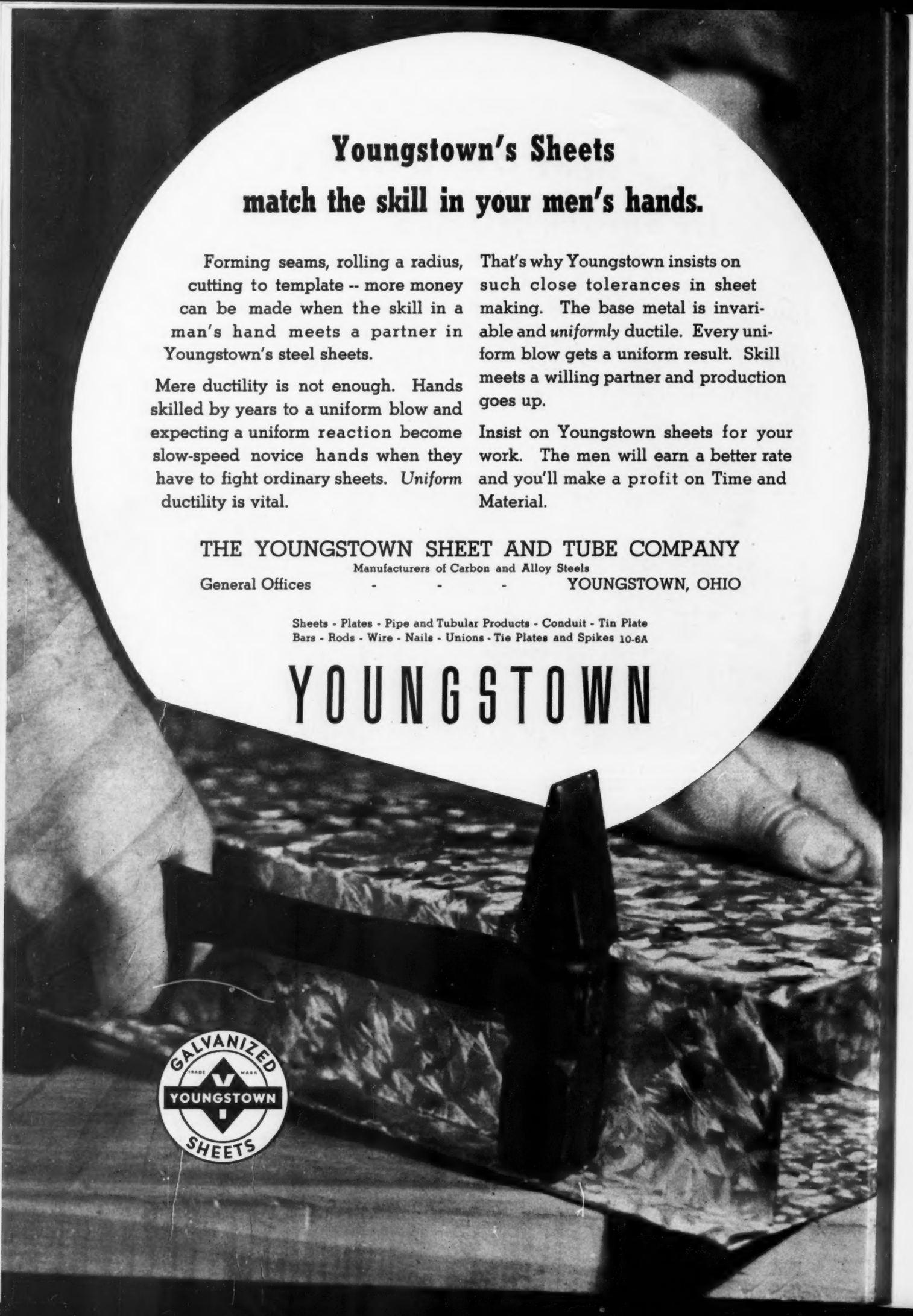
Sheet metal workers tell us that sales are easier with U·S·S Stainless Steel, because their customers know that U·S·S is the finest name in steel. And they appreciate the engineering service our specialists give, both in the selection and application of the proper grades and finish of material.

U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL



Youngstown's Sheets
match the skill in your men's hands.

Forming seams, rolling a radius, cutting to template -- more money can be made when the skill in a man's hand meets a partner in Youngstown's steel sheets.

Mere ductility is not enough. Hands skilled by years to a uniform blow and expecting a uniform reaction become slow-speed novice hands when they have to fight ordinary sheets. *Uniform* ductility is vital.

That's why Youngstown insists on such close tolerances in sheet making. The base metal is invariable and *uniformly* ductile. Every uniform blow gets a uniform result. Skill meets a willing partner and production goes up.

Insist on Youngstown sheets for your work. The men will earn a better rate and you'll make a profit on Time and Material.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - - - YOUNGSTOWN, OHIO

Sheets - Plates - Pipe and Tubular Products - Conduit - Tin Plate
Bars - Rods - Wire - Nails - Unions - Tie Plates and Spikes 10-6A

YOUNGSTOWN

Operator using the G-E Mutator at the C. Frauneder Company, Oakland, Calif. In one year this arc welder saved $525

$525 SAVED IN ONE YEAR
20% Increase in Welding Speed with G-E Mutator Arc Welder

A 350 per cent return on his investment in a new General Electric light-gage Mutator arc welder is reported by Mr. C. Frauneder, manufacturer of ornamental metal work, Oakland, Calif.

"Not only has this machine saved us $525 in one year over the process formerly used," says Mr. Frauneder, "but it does the work about 20 per cent faster. We use the welder considerably in fabricating doors and panels for store fronts, and it is helping us obtain perfect welds at a much lower cost."

Enthusiastic testimonials like this are not exceptional. Since this low-current d-c machine was introduced, scores of users have told us the same thing. Its arc is "soft" and easy to strike; it provides good penetration; and it is a real money maker for those who fabricate or repair material requiring welding currents of 15 to 90 amperes.

Does your work involve the fabrication or repair of light-gage metal? If so, let the nearest G-E arc-welding distributor or G-E sales office demonstrate this set that has saved the Frauneder Company and others money. It may be just the right machine for your job. Or send the coupon to General Electric, Schenectady, N. Y.

General Electric
Dept. 6B-201, Schenectady, N. Y.

☐ Please send me Bulletin GEA-2447C, describing the G-E Mutator.

☐ Can I use the G-E Mutator successfully on my work? (Attach description of work.)

NAME .....

FIRM .....

STREET ..... STATE 140-82

CITY .....

GENERAL ELECTRIC

Filing No. 8748

CRESCENT.. A NAME THAT'S SYNONYMOUS WITH WORTHWHILE TOOLS

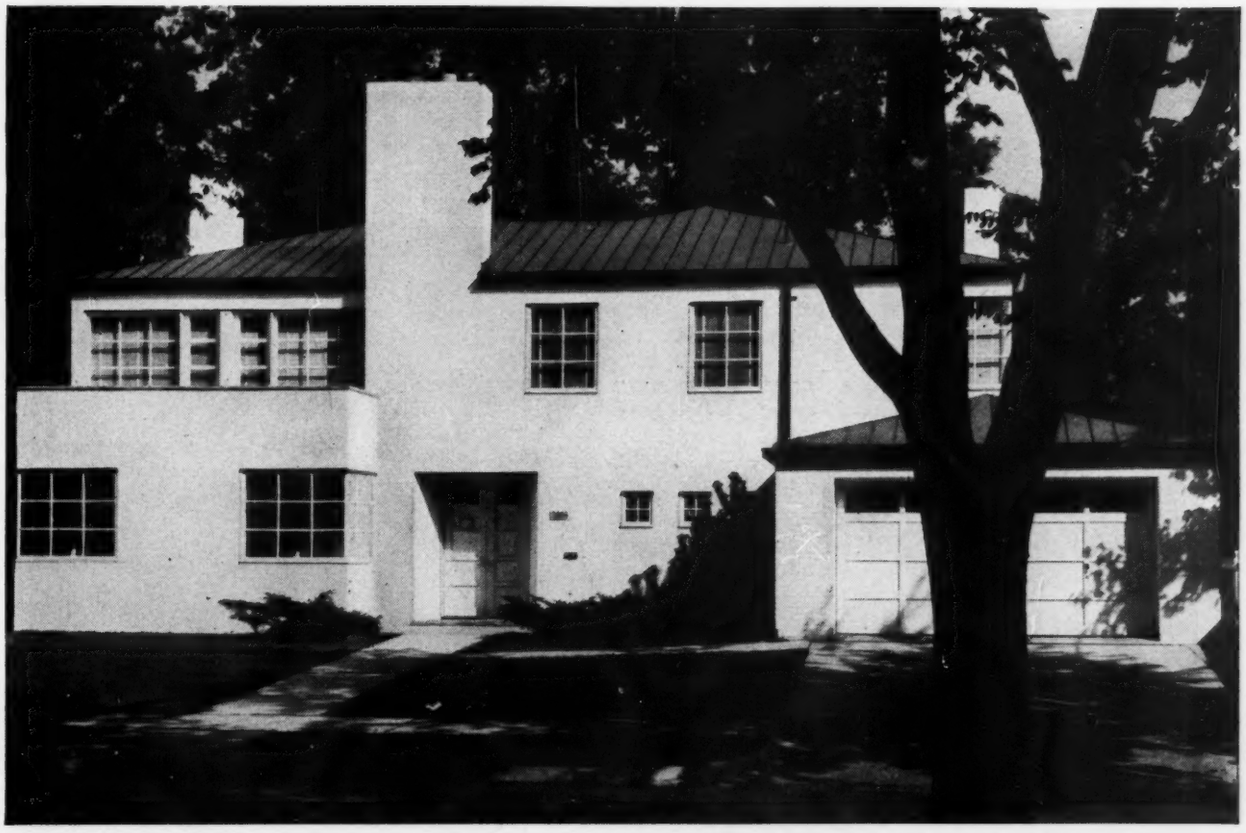
For a third of a century, Crescent has been making fine tools that have earned the respect of mechanics everywhere. Good design, through-and-through quality and greater convenience and utility have been our aim. Many of the tool industry's important advances have been pioneered by Crescent—some, today, are still exclusively ours. Notable is the series of gruelling tests which each and every Crestoloy Plier must successfully pass before it receives the distinctive blue and silver Crestoloy Tag.

There is one sure and simple way of getting really worthwhile tools—specify and insist on Crescent.

After cutting a piece of *hardened* plow steel wire in this Testing Machine, every Crestoloy Cutting Plier must then cut cleanly through a strip of .003" bond paper so that the end drops free in order to get the identifying Crestoloy Tag.

This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily

CRESCENT TOOL CO., JAMESTOWN, N.Y.



The house of Dr. George Calingaert, Detroit, Michigan. J. Robert Swanson, Architect. Photo by Tebbs.

THE Roofing for Metal Craftsmen

Anaconda Economy Copper

THIS good looking, durable material offers sheet metal men an opportunity to get profitable residential roofing business. Designed especially for small roof surfaces, it weighs but 10-oz. per sq. ft., is relatively low in price, and easy to work. Yet in the narrow widths used (13¾" between standing seams) it provides the same rigidity and wind resistance as 16-oz. copper in wide widths. No other roof combines so many advantages (see list at right). You can get *Economy* Copper Roofing from any Anaconda Copper distributor. If you have not received a copy of our new 65-page installation manual, write for this book today.

ANACONDA
from mine to consumer

Anaconda Copper

THE AMERICAN BRASS COMPANY—General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

CONTRACTORS! Use this unbeatable combination of advantages to convince prospects that Anaconda Economy Copper is *the* roof for their new homes.

1. APPEARANCE...Copper increases in beauty with age, blending perfectly with stone, brick, wood and foliage.

2. DURABILITY...Both in the United States and in Europe, countless copper roofs defy time and weather.

3. COOLS FASTER . . . Copper cools rapidly as soon as the sun goes down.

4. FIRE-PROOF...Copper roofs eliminate the flying spark hazard.

5. LIGHT WEIGHT...Economy Copper Roofing is much lighter in weight than wood, tile, asbestos or slate.

6. PROTECTS INSULATION . . . Being moisture-proof, it keeps under-roof insulation dry —thus preserving efficiency.

3812B

there's a Difference!

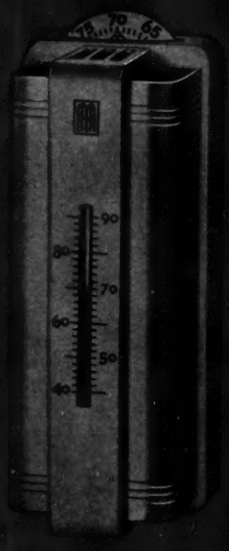
HEAT ACCELERATION
is not
HEAT ANTICIPATION

ONLY Minneapolis-Honeywell Acratherm, Chronotherm and Da-Nite Acratherm have "Heat Acceleration"– a revolutionary development of the exclusive M-H "Series 10" circuit.

M-H "heat accelerated" thermostats start the burner in the usual way. As soon as a definite rise in room temperature has taken place, but not until then, the Accelerator speeds up the action of thermostat. The result is short, frequent burner operations in mild weather when heat loss is small, and longer burner operations in cold weather – all automatically governed to meet existing conditions. Thus M-H "heat accelerated" thermostats maintain the desired room temperature under all weather conditions – provide distribution of heat to all parts of the building – and avoid wasteful overheating.

Recommend and install Minneapolis-Honeywell thermostats with the proved principle of "HEAT ACCELERATION." Your customers will readily appreciate the difference. Minneapolis-Honeywell Regulator Company, 2726 Fourth Avenue South, Minneapolis, Minnesota. Branch and distributing offices in all principal cities.

Dependable Controls Cost Less Than Service



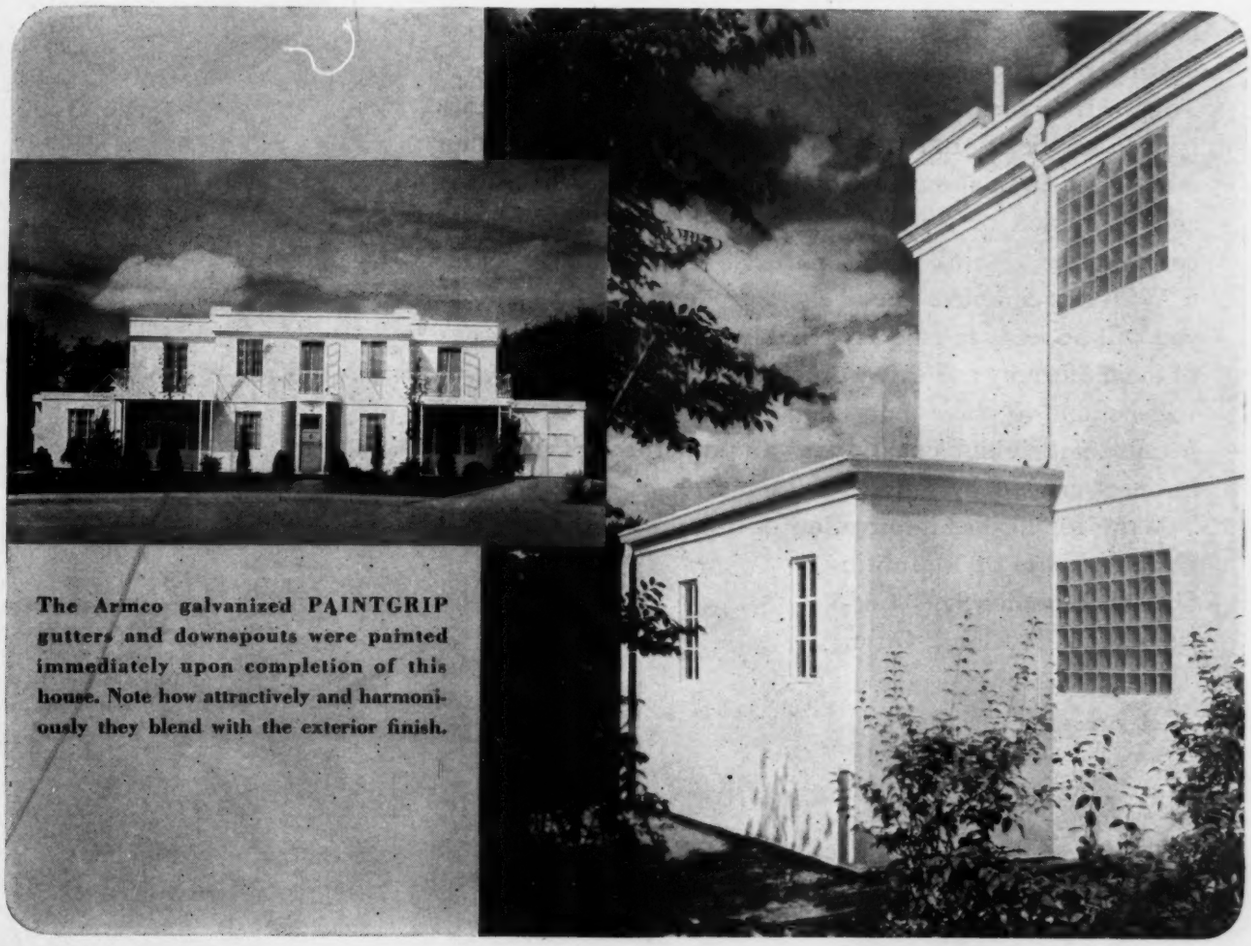
THE ACRATHERM

MINNEAPOLIS-HONEYWELL

NATIONAL PNEUMATIC CONTROLS
BROWN INDUSTRIAL INSTRUMENTS

Control Systems

There's Money for You IN ARMCO PAINTGRIP!



The Armco galvanized PAINTGRIP gutters and downspouts were painted immediately upon completion of this house. Note how attractively and harmoniously they blend with the exterior finish.

Here's a sales point your customers will quickly appreciate. Tell them that the old, time-consuming restrictions on painting galvanized sheets are out. They can speed the work and get a better job with galvanized Armco PAINTGRIP Sheets.

These sheets are specially processed to take paint immediately and hold it long. No acid etching or weathering is required, thus assuring the full protection of galvanizing. Paint economy is another big advantage. The insulating PAINTGRIP film helps keep paint elastic—makes it last longer without peeling or flaking. Also point out that a base metal of durable ARMCO Ingot Iron will add years of trouble-free service to the installation.

All this means a lot to you in terms of sales and profits. Recommend Armco PAINTGRIP for all exposed sheet metal work that needs the immediate beauty of paint. The Armco distributor can quickly supply you with the right grade, gage and size for the job in ARMCO Ingot Iron or plain and copper bearing steel. And be sure to ask him about the many valuable business promoting services he offers. The American Rolling Mill Co., 2611 Curtis St., Middletown, Ohio. District Offices in Key Cities.

ARMCO

ARMCO PAINTGRIP SHEETS

HERE'S TO A ROSY FUTURE *with*

REG. U. S. PAT. OFF.
REPUBLIC
STEEL
SHEETS
—there's a grade, size and finish for every need

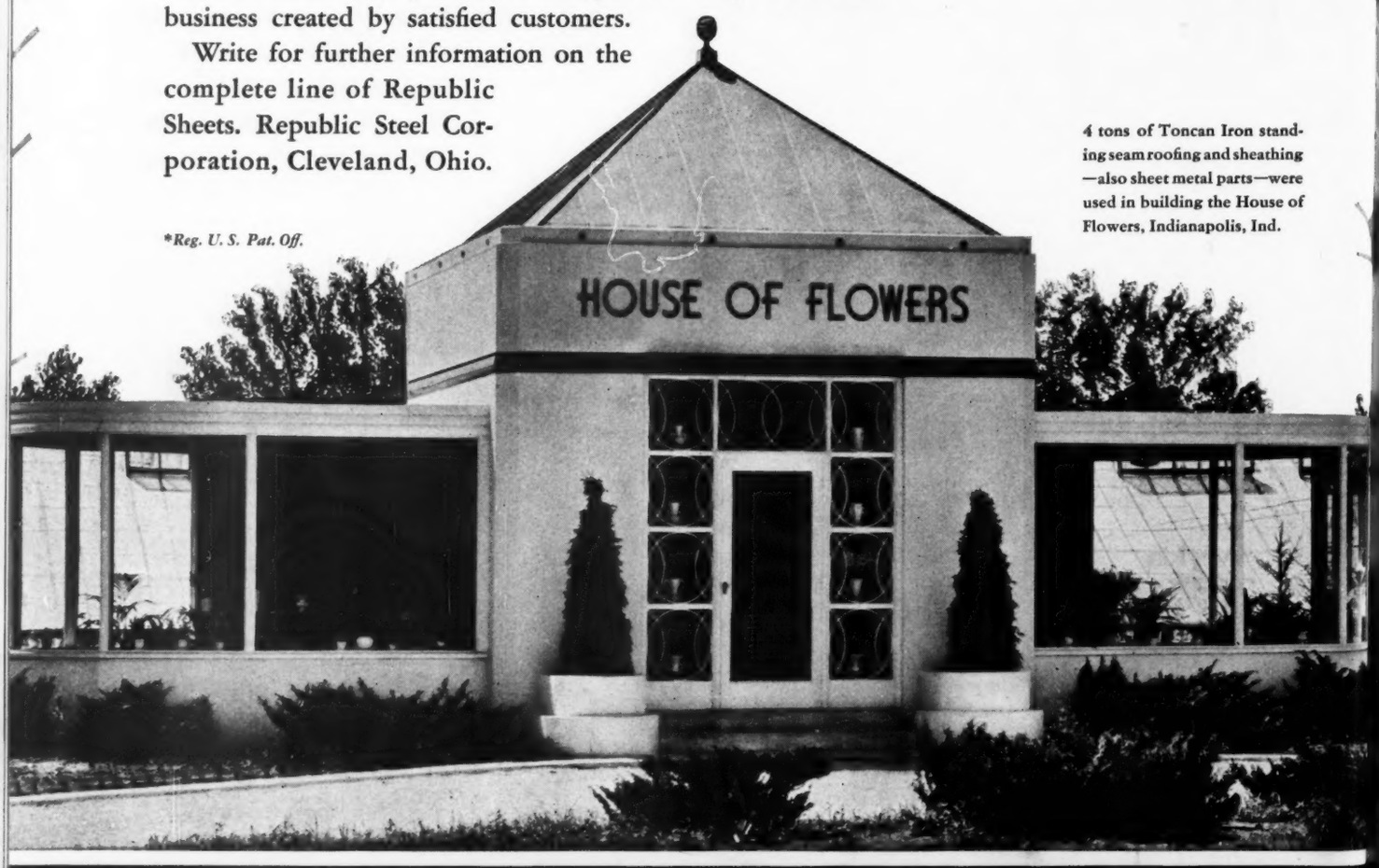
Omitting all flowery wording, here's why you can look to a rosy future if you stock the complete line of Republic sheets.

The line is just that—COMPLETE. It includes steel, copper-bearing steel and rust-resisting Toncan* Copper Molybdenum Iron in black, tightly galvanized or easy-to-paint galvannealed finish, and either flat or corrugated. It includes Taylor copper-bearing roofing ternes—also steel, copper-bearing steel and Toncan Iron roofing in a wide variety of styles and patterns. It includes sheets of ENDURO*, Republic's Perfected Stainless Steel—the finest sheet that money can buy, either for beauty and decoration or for sanitation, long life and resistance to corrosion.

With this complete line of sheet products at your disposal, you will be ready to take any type of sheet metal job. Because of the uniformity and easy workability of Republic sheets, you will be able to make more money on fabricated work. And because of their high quality, you will profit through additional business created by satisfied customers.

Write for further information on the complete line of Republic Sheets. Republic Steel Corporation, Cleveland, Ohio.

*Reg. U. S. Pat. Off.



4 tons of Toncan Iron standing seam roofing and sheathing—also sheet metal parts—were used in building the House of Flowers, Indianapolis, Ind.

REPUBLIC STEEL

BERGER MANUFACTURING DIVISI
UNION DRAWN STEEL DIVISI
NILES STEEL PRODUCTS DIVISI
TRUSCON STEEL COMPANY
STEEL AND TUBES, INC.

AMERICAN ARTISAN

Volume 107 Number 7

Sales Mean Jobs

HIGHLY interesting to business men, large and small, is the National Salesmen's Crusade announced in the middle of May. This plan to bring prosperity does not involve any artificial stimulation of business, it contains no mysticism or magic, rather, its foundation is plain, garden variety of hard work.

First suggested by Nash-Kelvinator, which firm tried the idea out in Lincoln, Nebraska, with remarkable results; later presented to 21 groups of business men in 21 cities across the country; today adopted or being considered by scores of cities of all sizes—the plan springs from the assumption that if products are sold more people will have jobs; more jobs mean greater and wider buying power; wider buying power means prosperity.

Interesting indeed, in this era of left handed theorems are the simple, easily understood truths on which the crusade is based. These are—

1. Unemployment is a national problem.

2. Though undoubtedly impaired, the ability to buy still exists among our citizens. Though millions are unemployed, many other millions are at work.

3. A definite step toward the reemployment of the unemployed is the sale in increased quantities of our farm and factory products to those who **are** at work. This will create employment and—with the restoration to buying power of those now living on a subsistence scale—we can expect a constantly accelerated demand for these products.

4. The American Salesman faces a remarkable opportunity to be of help in solving the unemployment problem. It is his task to strengthen old and create new desires to a point where the desires outweigh the fears that have kept people from satisfying their normal needs.

5. The business of any manufacturer or any industry will be helped by the success of other manufacturers or other industries.

What the crusade accomplished in Lincoln can undoubtedly be accomplished in most communities. And more to the point, what was accomplished on a large scale in Lincoln, by a massed organization of the entire city, can also be accomplished by the individual business man on a much smaller scale.

For example, the Ten Best Prospects Sales Plan suggested in American Artisan of August, 1932 was based on the theory that if every contractor would write down the names of his ten best prospects and after each name the service or product each should buy, this outline would serve to keep sales effort concentrated on a definite goal. The National Salesmen's Crusade is different only in that it visualizes an entire community organized to contact the ten or twenty or 100 best prospects of each participating business man.

The Lincoln campaign was successful in part because the groundwork was laid beforehand with suitable publicity. The contractor can do much the same thing by organizing a campaign of direct mail to reach the home owner at set intervals for a period before the first actual call is made.

A typical individual campaign can be outlined like this—you select from your lists of customers or prospects those persons who are employed or have an income. The total of these names defines the scope of your effort. From your records or from personal investigation the service or product each prospect needs most is entered after the prospect's name. From the manufacturers of these products descriptive booklets or direct mail literature is secured. The prospects needing a particular product or service are grouped together—say all prospects for a new furnace. The available literature is laid out for mailing over a period of two or three weeks. Personal letters explaining the reason for the mailing (like, better, more careful work can be done in the summer) lend the personal touch. Then each day a certain number of calls are made. It is important that this number of calls be made each day because for any product or any average sales price a certain number of calls must be made to get a certain number of prospects or a certain number of sales.

As the Lincoln campaign demonstrated, there is business to be had, sales to be made, if only someone will go after it. Sales mean jobs. Jobs mean prosperity.

New Applications of Light Weight Sheet Copper

Among the interesting sheet metal developments of recent years is the increasing applications made of light weight sheet copper for water-proofing, termite protection, insulation, built up roofing, etc. This article presents current practice in several of these applications in the sheet metal field.

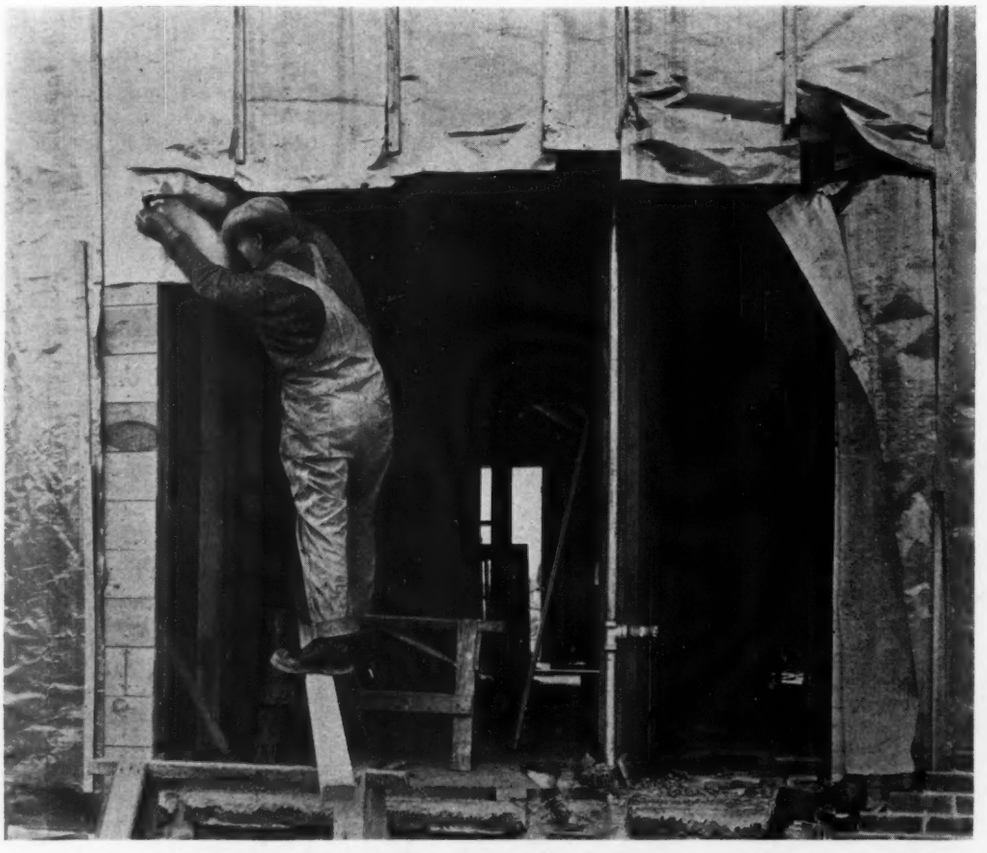
INTERESTING developments have occurred in recent months in the expanding use of architectural sheet metal. For example, the new uses of sheet copper in waferlike thinness-gauges ranging from 1 oz. to 7 oz. per sq. ft. In these light weights, this material is expected to displace ordinary building paper.

To cite an example, in recent Federal Government specifications lead shower stall pans were called for in the *plumbing* contract.

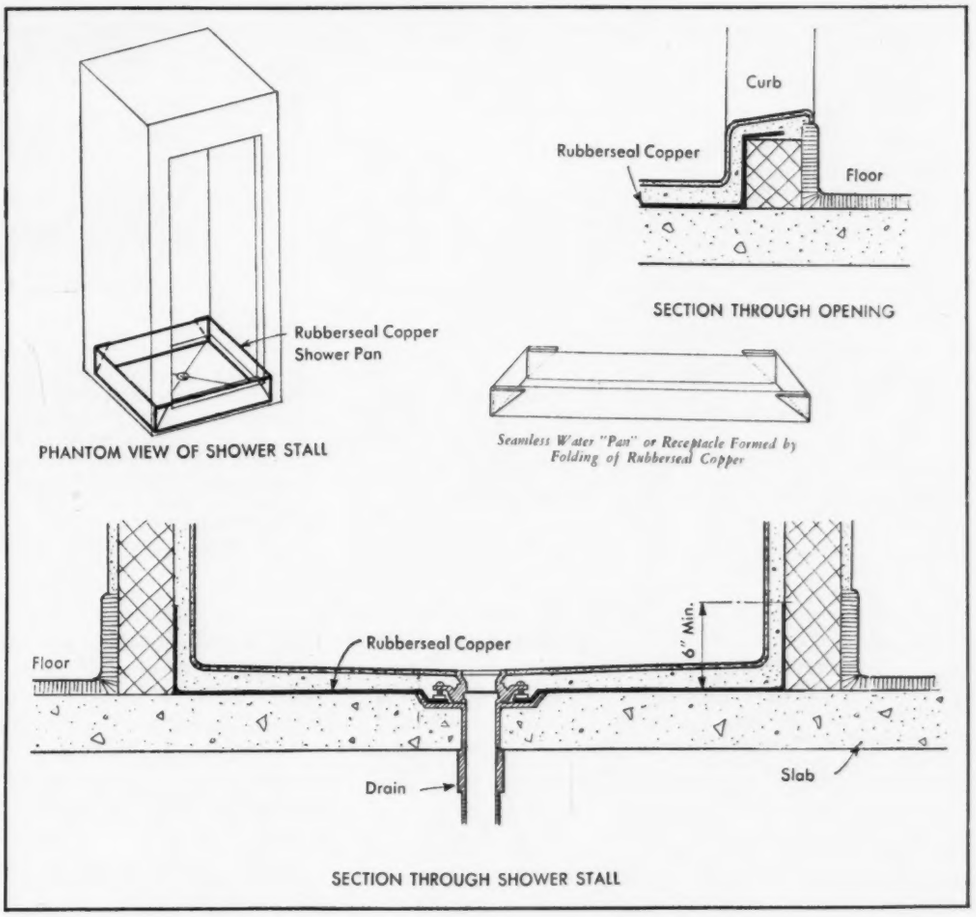
But specification changes were made that resulted in the substitution of 7-oz. sheet copper, coated on both sides with a thin layer of asphalt compound and the shower stall pans this time were found in the *sheet metal contractor's* contract.

J. J. Fisher Co., Brooklyn, N. Y. and E. Van Norden, Boston, Mass., sheet metal contractors, are understood to have contracts covering the aforesaid pans for installation at the United States Military Academy, West Point, N. Y. Among points in favor of copper shower stall pans is that corners are simply folded, without seams of any sort. The sheet metal then is carried 6 in. up under stall siding all around, making a permanently tight basin.

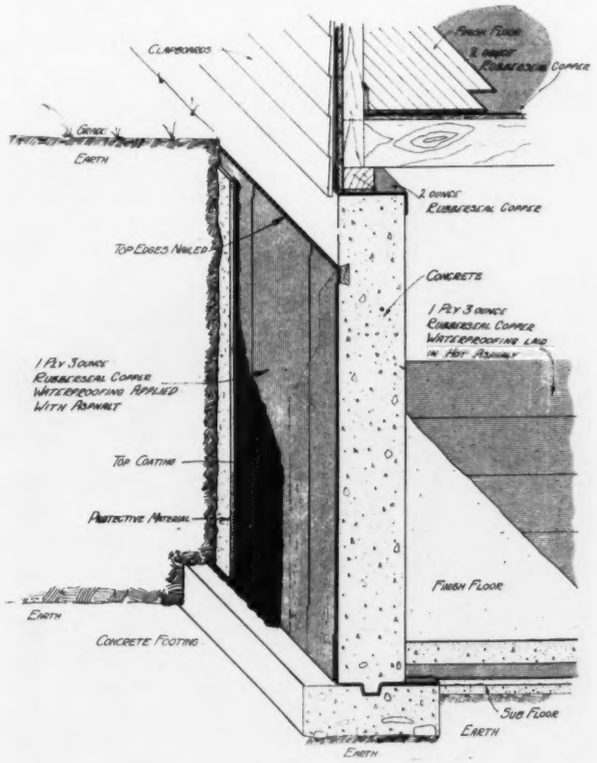
Evidence of the many uses developed for light-



Copper armored "Sisalkraft" (The Sisalkraft Co.) being applied as insulation and vapor seal on the Westchester County Model Home, a 1936 project.



Construction details of a light weight copper shower pan, showing method of forming pan by folding (no locks); application at shower door; and method of setting drain. Below —Method of waterproofing outside of cellar walls by the "Membrane" method using two plies of 2-oz. copper applied in hot pitch or asphalt. Also waterproofing between wall and footing and water-proofing laid between sub-floor and finished floor. Both drawings by courtesy of Mitchell-Rand Mfg. Co., manufacturers of "Rubberseal Copper."

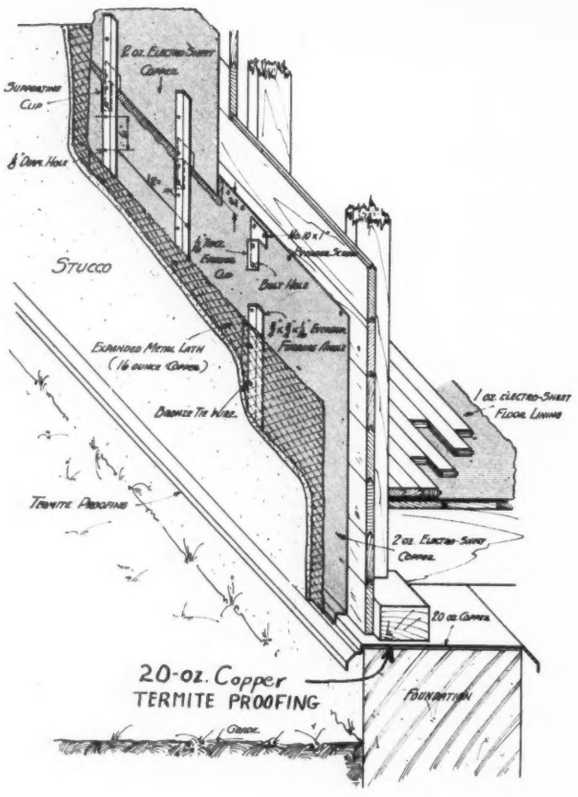


weight sheet copper of gauges indicated appears in a list that includes: footing waterproofing, basement floors, foundation membrane waterproofing, termite shields between foundations and framing, floor insulation, window flashings (concealed), attic floor insulation, built-up roofing, coping weatherproofing, chamber lining, shower pans, spandrel and lintel waterproofing, sound insulation.

Starting at the floor and working upwards according to the experience of I. Wolkowitz, president, Brooklyn Roofing Corp., Brooklyn, N. Y., who uses many thousands of square feet of thin copper yearly, basement floors can be made permanently dry if one applies one layer of 3-oz. sheet copper in hot asphalt on top of the cellar sub-floor. The finished floor then is laid on top of the sheet metal.

At walls the flooring rests on an extension of sheet copper of the same or slightly greater thickness that already has been placed between footing and walls. Wall tightness can be obtained by laying sheet copper vertically, with 6-in. laps, down the outer walls. Further foundation protection suggests the use of a layer of hot tar or asphalt on the exterior of the copper sheeting, then adding a protective sheet of tarred roofing paper or similar material.

Progressing upward, perhaps the next position requiring safeguarding with sheet metal, reminded Mr. Wolkowitz, is the shop fabrication and installation of a Termite shield between framing and foundation. This has a 4-in. exterior downward-slanting metal shield that deters Termite entrance and affords weather drainage. By carrying the metal over the top of the foundation and turning



the interior edge downward inside, weathertightness also is assured.

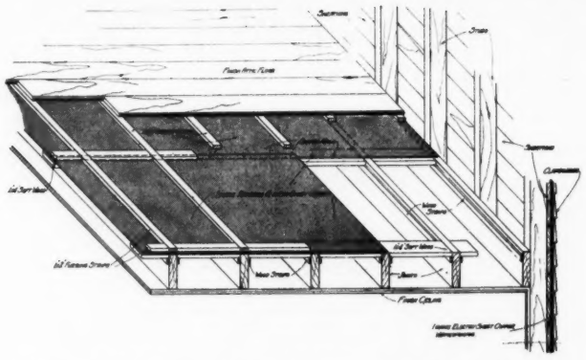
Referring to siding protection, the Brooklyn Roofing Corp. head asserts that ordinary sidings such as clapboards, stucco and brick are leaky and porous. Sidewall dampness can ruin ordinary building paper, which crumbles and otherwise disintegrates, and so increases infiltration and interior dampness and winter chill. A practical protective method is to lay sheets of copper with generous laps, over the sheathing, nailing with copper nails.

The same situation applies to all sort of roofing. Evidently building paper alone is not adequate to bring real protection against weather that seeps in between slates, shingles and, in fact, most types of roofing other than sheet metal. So, lay a lining of featherweight copper next to roof sheathing wherever one cannot secure an order for an all-sheet metal roof.

This class of metal finds ready acceptance in connection with built-up roofing, frequently laid on flat surfaces. Place a layer in hot tar or asphalt, then cover with an exterior layer of asphalt or similar material and one has an enduring roof.

Considerable attention is being paid nowadays to attic floor insulation, finds the Brooklyn Roofing Corp. Better than simply filling in areas between joists, then laying finish flooring, is the use of a layer of lightweight sheet copper, with longitudinal seams, on top of joists. Next place furring strips over the butted metal edges, then lay the finished flooring on top of the furring strips. The result is two dead air spaces, that between joists and that between furring strips.

Occasionally one encounters unusual applications



Above—A thin membrane of copper, nailed to top of attic floor joists with edges clamped with furring strips, creates two dead air spaces. With cellular insulation the copper protects the insulation from moisture. Left—Termite strip between foundation and above-grade wall (also water table) and weather-proofing of a frame-stucco wall with 2-oz. copper sheets lapped horizontally. Both drawings by courtesy of The American Brass Co., from "Electro-Sheet Copper Handbook."

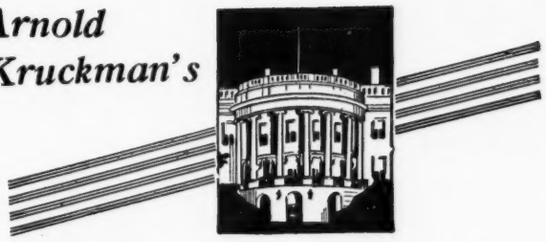
◆ ◆

of lightweight sheet copper. For instance, Meyer Black, Philadelphia, Pa. sheet metal contractor, recently laid several thousand square feet over siding of a gas chamber in a cigar factory. The tobacco used in cigars customarily is fumigated with poisonous gas to kill insects, their eggs and larvae before use in smokables. By covering the six surfaces of this chamber with this type of copper, tightness was assured.

N. W. Martin & Bro., Richmond, Va., laid 16,000 sq. ft. as spandrel waterproofing at a new Philip Morris cigarette factory there, while Brown-Kerr Co., Chicago, Ill., laid 125,000 sq. ft. mostly 7-oz. weight, on a large Federal Housing project there.

"Electro Sheet" (American Brass Co.) being applied to outside surface of concrete foundation walls.

Arnold Kruckman's



Washington Letter

Low Cost Housing

MANY industries and organizations are contributing money, materials and advertising space to stimulate the public's interest in home modernization and construction. Some of the more important or interesting campaigns are as follows:

Out in California, an extraordinary number of the $2,500 houses have been built, with much profit to contractors and equipment dealers, as the result of a special drive by the Bank of America, which has branches in every small hamlet, town or larger city of the State. In California and elsewhere, groups of these small houses are being built for re-sale with astonishing success.

Demonstration homes, emphasizing this class and similar low-cost homes, in connection with the Title I and Title II FHA amended program, have been scattered about the country by the National Lumber Manufacturers' Association and other trade organizations. Eight such houses, in a group, are exhibited in the vicinity of Washington. They were built of standard materials, at average building trade wages. They range in price from $5,000 to $2,500.

Another group of six, sponsored by the Red Cedar Shingle Bureau, ranging from $4,500 to $2,500, are exhibited to thousands weekly, across the Potomac, in Virginia. Collectively, various trade agencies have built 3,000 such demonstration houses. The goal this year is 5,000.

Manufacturers Efforts

Industrial groups cooperating in this form of popularization include the American Radiator Company, the Association of General Contractors, the Institute of Steel Construction, Johns Manville Corporation, the U. S. Chamber of Commerce, the National Paint, Varnish and Lacquer Association, and the National Retail Lumberman's Association. The Structural Clay Products Institute has built six types of model homes to fit into the FHA program. The American Institute of Steel Construction is working on low-cost steel frame houses; and the cement industry has focused special interest on ten small concrete houses built on unproductive property in Nashville, Tenn., and rented quickly at from $17 to $20 per month.

Chamber of Commerce Efforts

To help the industries involved in building to spread the word concerning the revival of Title I and Title II, the Chamber of Commerce of the United States, in cooperation with the FHA, has organized Better Housing Committees in more than 4,000 communities of the United States. These Committees vary in number of members, according to local inclination. Householders, women's organizations, business people, professional workers, civic interests, and similar facets of local life are represented. The FHA supplies information and printed matter, but keeps its representatives off the Committee as members.

In many communities the Committees have accomplished amazing results in kindling the interest of the populace. One of the main objects of this organization is to awaken an interest in improved housing standards. This interest is expected to be reflected eventually in the development of the large-scale multi-family housing program that is really the long-range, chief objective of the FHA. Your Chamber of Commerce will advise you if there is such a Committee in existence in your community.

It is natural that these local Committees should maintain a close liaison with the nearest FHA agency—of which there are 63 scattered around the country—and should establish good relationships with the approved financial institutions in or about the community. The FHA has designated approximately 12,000 such lending organizations, a large proportion of which are in Pennsylvania, New Jersey, Ohio, New York, Indiana, California, Missouri, Illinois, Iowa, Minnesota, Texas, Virginia, Wisconsin and Massachusetts. The grand total in the U. S. is composed of 8000 banks, 3,000 building and loan associations, 300 insurance companies, and 500 miscellaneous finance institutions.

Heating Under PWA

Late in June the White House formally authorized the announcement that it had approved the expenditure of $13,400,000 for heating equipment, and $8,700,000 for plumbing equipment, in connection with the new PWA program which is part of the spend-lend drive.

Other projects to be approved immediately by the White House will use additional heating equipment and material valued at $32,000,000, and additional plumbing equipment and materials valued at $20,000,000. The aggregate value of all heating and plumbing equipment to be used in connection with all PWA projects under this program is estimated at a gross value of $62,000,000.

It is estimated provisionally that all agencies and departments of the Government will spend out of the emergency funds for heating and plumbing equipment during the next fiscal year, ending July 1, 1939, approximately a grand total between $200,000,000 and $250,000,000.

The Cleveland Plan for Apprenticeship Training

By Willett M. Riley

Instructor, Sheet Metal Training Division
Cleveland Trade School

BY way of describing Cleveland's course of apprenticeship study, I am submitting an outline or certificate of graduation that shows detailed and complete information on the extent of the course. It shows what we attempt to cover, something of how time is allotted, some of the books and references used. A great deal of the work is in the form of catalog and trade literature.

The Employers' Association and Sheet Metal Workers Local Union appointed a committee to make a survey and outline a course of study for the apprentices of our school. Such an outline was completed and we have built around it what we think is a fairly complete course. However, we find it rather difficult to set up at once a course on air conditioning as our apprentice program was just revived February 1, 1937, having been discontinued for a few years during the depression. I am glad to report that we are moving along again and by the time our present apprentices are ready for air conditioning we hope to have lesson sheets and material available for their use. There is little doubt but what it will adhere pretty closely to the principles set up by the New Technical Mechanical Code and the ASH&VE Guide for 1937.

So far as aims and intents are concerned, it is our hope to make general, all-around mechanics, capable of fitting into any shop or division of the trade.

Our rules and regulations governing the apprentice show pretty closely how our apprentices are watched and guided through the four years of apprenticeship, by a committee representing the Employers' Association, the Union and the Board of Education.

The apprentice serves a probationary period with the employer and if he proves satisfactory, he is registered as an apprentice with the Union. By this act the employer allows the boy to attend school one day (8 hrs.) every two weeks for a period of 4 years. Apprentices are paid their regular daily rate (by their employers) for each day they attend school. This has proved to be a very successful

STUDIES	TEXT BOOKS RECOMMENDED AND USED / AMOUNT OF WORK	No. of weeks	Recitations per week	Length of each period	Grade	Credit in units
MATHEMATICS Practical Geometry	Williams—Review of Fundamentals Daugherty—Mensuration Neubecker—Geometry Kittridge—Geometry	6	1	2 hr.		
SCIENCE General Science Chemistry	Lake's General Science, McPherson and Henderson's First Course in Chemistry Black and Davis—Physics	6	1	2 hr.		
	Fluxes, Garanie Action. Heat Losses, etc.					
DRAWING Mechanical	Svensen—Essentials of Drafting French—Engineering Drawing	6	1	2 hr.		
	Principles of Mechanical Drawing					
ARCHITECTURAL	Svensen—Shelton—Architectural Drafting.	6	1	2 hr.		
	Fundamentals of Architectural Drawing					
PICTORIAL	French and Svenson—Mechanical Drawing for High Schools Sturtevant—Mechanical Pictorial	6	1	2 hr.		
	Pictorial Representation					
DEVELOPMENTS	Daugherty, Sheet Metal Pattern Drafting and Shop Problems	18	1	2 hr.		
	More than 150 Practical Developments with a like number of Shop Problems. Developments and Intersection of surface					
Parallel Line Developments	Daugherty—Sheet Metal Pattern Drafting and Shop Problems. Kittredge, New Metal Work and Pattern Book Neubecker—The Universal Sheet Metal Pattern Cutter Vol. I	18	1	2 hr.		
	A study of the principles of parallel line development					
Radial Line Developments	Daugherty, Kittredge, and Neubecker Radial Line Developments their basic principles studied and applied	18	1	2 hr.		
TRIANGULATION	Daugherty, Kittredge, Neubecker and Kidder—Triangulation Applied to Sheet Metal Pattern Cutting	18	1	2 hr.		
	Practical Drafting and Shop Problems in Triangulation studied					
SHEET METAL WORK	Williams—The New Tinsmiths Helper and Pattern Book Broemel—Sheet Metal Workers Manual Army Tage,—Metal Work for Schools and Colleges Grayson—General Metal Work Butler—Problems in Metal Work	18	1	2 hr.		
	Elementary Sheet Metal working practices					

STUDIES	TEXT BOOKS RECOMMENDED AND USED	AMOUNT OF WORK	No. of weeks	Recitations per week	Length of each period	Grade	Credit in units
SHEET METAL WORK Exterior Skylights and Ventilation Metal Comices Metal Ceilings Warm-air Furnaces Heating and Ventilating Systems Blow Pipe and Exhaust Systems Fire Doors and Kalamein Hollow Metal Doors and Trim Hollow Metal Windows Restaurant, Kitchen and Hotel Equipment Protective Coating and Paints	The National Association of Sheet Metal Contractors—Standard Practice in Sheet Metal Work Copper and Brass Research Association, Seams for copper roofing, copper roofing and copper flashings Sheet Steel Trade Extension Bureau—How to Lay Steel Roofing American Rolling Mill Co.—Galvanized Iron for Roofs and Roof Drainage American Society of Heating and Ventilating Engineers Guide The International Nickel Co.—Bulletins and Technical Literature Electro Metallurgical Co.—Stainless Steels and their Uses Allegheny Steel Co.—Trade Data and Bulletins Aluminum Co. of American—Architectural Uses of Aluminum American Sheet and Tin Plate Co.—Literature Concerning Sheet Metal The Newport Rolling Mill Co.—"Gohi" Genuine Open Hearth Iron		24	1	2 hr.		
WELDING Soldering	Broemel, Army Tage and Grayson A study of the principles and methods of soldering		4	1	2 hr.		
Oxy-Acetylene	Plumley—Oxy-Acetylene Welding and Cutting The Welding Engineering Publishing Co.—The Welding Encyclopedia Oxweld Acetylene Co.—The Oxwelder's Manual		6	1	2 hr.		
Electric Arc, Spot, Butt	Lincoln Electric Co.—Procedure Hand Book of Arc Welding General Electric Co.—Arc Welding and Cutting Manual Broemel—Sheet Metal Workers' Manual		4	1	2 hr.		
Warm-Air Furnace Installation Heating and Ventilating	American Society of Heating and Ventilating Engineers.—Guide Allen and Walker—Heating and Ventilation Code—National Warm Air Heating Association—Technical Mechanical Code. International Library of Technology—Heating and Ventilating The National Association of Sheet Metal Contractors—Standard Practice in Sheet Metal Work Daniels—Warm Air Furnace Heating		12 6	1 1	2 hr. 2 hr.		
ESTIMATING	Blue Print reading and estimating from plans		6	1	2 hr.		
SAFETY MEASURES	Literature from State Industrial Commission Safety Council		5	1	2 hr.		
OVERHEAD	What it means, How applied on each job		5	1	2 hr.		
PRACTICAL SHOPWORK	Practical Shop Problems are provided as nearly as possible to correlate with theory		96	1	4 hr.		

method in all of the building trades in Cleveland. A report of each day's school work is mailed to the employer each week.

For the journeyman, we maintain classes meeting two nights per week for two hours each or one night for three and one-half hours. These men are generally more anxious to do drawing and welding or some form of theory than shop work, since most of them get all the actual practice they need in their daily work. We have no system that makes it compulsory that the journeyman attend school.

One of the night school groups has gone quite thoroughly into air conditioning to the extent of drawing detailed plans of a house, determining the total heat losses, size of heating plant required, placing heat openings and cold air returns, as well as working out a cost sheet for the entire completed job. We hope more will be done in this direction as times improve.

For the part-time day school students, we have a drawing course, set up that covers over 100 drawings of sheet metal articles. First, there is a group of 36 parallel line developments, second, 24 of radial line developments, third, 24 in triangulation and finally, 24 of a miscellaneous nature.

Upon completion of the course, the student is granted a Certificate of Scholarship, specifying that the boy was graduated from the Cleveland Trade School, on a certain date. This certificate is signed by the teacher, principal, union official, committee chairman and by the contractor. As shown following, this certificate gives a detailed resume of the work done during the four years.

The Cleveland Plan

JOINTLY the Cleveland Board of Education, Sheet Metal Employers Association and the Sheet Metal Workers Union have endorsed and given their support to the idea of vocational training. Through joint committees of each of these organizations, they have been of material assistance in establishing and maintaining the Sheet Metal Division of The Cleveland Trade School.

General Information

Committee members are representatives of their bodies and are appointed as agents of their organizations to direct and supervise the activities of the school for the mutual interest of all parties concerned including the general public.

The Joint Apprenticeship Committee has adopted these rules, governing attendance and matters of mutual interest to both employers and apprentices with reference to the training and advancement of the apprentices. Observance of these rules is guaranteed by the Joint Committee. Cases of violation of these rules should be reported to the committee.

All differences or misunderstanding arising, pertaining to or affecting the parties involved in carrying on the apprenticeship training, must be adjusted through and to the satisfaction of the Joint Apprenticeship Committee. Both parties are privileged to present their differences for the consideration of the committee. Should willful or persistent violation of the regulations occur, and if circumstances warrant it either the apprentice, employer or both may be cited to appear before the Joint Apprentice Committee where an impartial adjustment shall be given.

The Smith-Hughes Law requires that a boy entering the trade school classes, must be over sixteen but not over twenty-one years of age.

Recommendations

That young men selected to become the future sheet metal workers of our city shall at least have acquired passing grades in the subjects comprising the tenth grade of our public schools.

Since the Sheet Metal Trade and the successful completion of the apprentice course is dependent upon the following foundation subjects: Mathematics, Geometry, General Science and Mechanical Drafting, it is reasonable to expect that the apprentice be prepared to advance in his chosen vocation, which will prove very decidedly a benefit to the employer.

Rules to Be Observed

By Apprentice:

1. Apprentices are required to register in the Cleveland Trade School immediately after being recognized as an apprentice.

2. Apprentices must attend school regularly one day of each two weeks except as those days fall on legal holidays.

3. When employed the apprentice is to be paid for his day in school the same as a day on the job. Being unemployed does not excuse the apprentice from attending school.

4. Absence due to illness, death in the immediate family and working out of the city, will be excused temporarily. Time thus lost must in all cases be made up in the near future.

5. When kept out of school by the employer, as in the case of the apprentice working out of the city, the time so lost must be made up within 30 days after his return to the city.

6. In any and all cases of absence the instructor must be informed concerning the reason for absence the day before the absence occurs, or at least, not later than 10 o'clock on the date the apprentice is due in school. Failure to comply with this regulation will result in the absence being reported to the Director of Apprentices, and the apprentice being summoned to appear before the apprenticeship committee. This will result in the apprentice being fined according to provisions set up in the rules for such neglect.

7. Other cases of absence caused by illness or deaths may be reported to the committee and time made up as the committee may rule after considering the report.

8. In accordance with action taken by the joint apprenticeship committee on April 30, 1927, the following fines were put into effect:

Tardiness, 1st offense	Excused
Tardiness, 2nd offense	$0.50
Tardiness, 3rd offense	1.00
Tardiness, 4th offense	2.00
Tardiness, 5th offense	3.00

Failure to attend lectures or other meetings for the benefit of apprentices, $1.00.

Failure to notify the Instructor or Director of Apprentices of absence and the reason for such before 10 o'clock on day of absence, $1.00

Absences, other than temporarily excused absences, $2.00.

Failure to appear before joint apprenticeship committee when ordered to do so, $1.00.

9. Fines or assessments imposed upon apprentices may be paid to the instructor who will issue a receipt for same, and keep a record of the amount of money collected. Fines must be paid within the time designated by the committee. In no case shall an apprentice be advanced to journeymanship without a clear record and the sanction of the committee.

10. Permission to take up temporary employment in other than the sheet metal trade may be granted should the employer be unable to keep registered apprentice employed.

11. The teacher shall not excuse the apprentice from school to attend to personal business without the consent of his employer. When so excused the time lost must be indicated on the time card to be presented to the employing contractor and time must be made up as indicated in rule No. 7.

12. Failure on the part of the apprentice to observe these regulations may result in his apprentice card being revoked.

Information to Employer

1. With the act of registering a boy as an apprentice the employer indicates his willingness and intention to indenture and send the apprentice to school.

2. The indenture contract is dated from date of registering the apprentice to four years from that date.

3. The employer shall respect the indenture contract and encourage his apprentice to do the same. He shall in no way hinder the apprentice from performing his obligation and agreements as set forth in the indenture contract and rules governing apprentices.

4. The Instructor issues a time card to each apprentice for each day in school and the employer should demand that his apprentice file same with the company in lieu of time card as proof of his regular attendance in school. This will also facilitate committee work on absence and tardiness. The employer must accept no excuses for the apprentice not having a time card properly signed.

5. The apprentice is due in school on the day assigned to him and should be there on that day except as provided in rules No. 4-5-6-7 for apprentices. A certain portion of the term's work is taken up on one day in school and on the following day another portion and so on throughout the term's work which means that there is a definite subject taken up for each day, so that lessons missed cannot be made up except on the day such lesson is presented to the class. Lessons missed often prove a handicap to the apprentice's progress.

6. In case of absence, when the apprentice is working out of the city, and for this reason is unable to inform the school of his absence and reason for such, the firm will be required to inform the school of the absence in time that records may be made and a temporarily excused absence entered against his name. Recognizing that it occasionally becomes necessary to keep an apprentice from work arrangements may be made with the instructor, to meet these occasions but this must not be a common occurrence.

7. New classes for beginning apprentices will be started at the first class meeting of group or section one in September, January and April until more satisfactory arrangements can be developed.

8. Employers should endeavor to have his apprentice enter the trade as nearly as possible at intervals of each eight months, this sequence places them in different classes and eliminates taking two boys from the same shop on any one day. It also makes possible to put them in classes of homogeneous grouping.

9. Failure on the part of the employer to regard these regulations may result in the withdrawal of the right to employ apprentices.

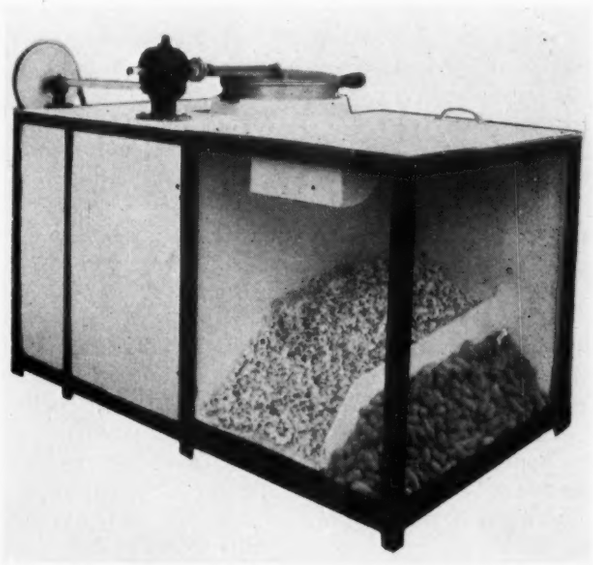
10. Every effort should be made at all times to keep your quota of apprentices in school. The price of instruction per pupil increases as the enrollment decreases. Hence the necessity for keeping up the quota.

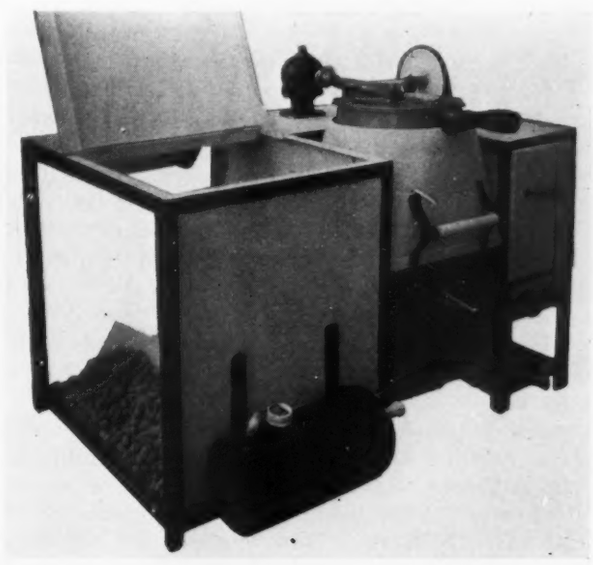
Shop Fabricated Pop Corn Machine

EARL R. TAYLOR, reader of American Artisan and operator of a restaurant, a plumbing and a heating shop in Malcolm, Iowa, wanted to buy a popcorn machine. His idea was that such a machine would bring in additional business and might even help along an idea he had had for some time—several months of vacation, self supporting, traveling around the country.

be able to regulate the intensity of the source of heat for best results. Then, too, certain varieties of corn require more heat to pop than others.

"I finally located the maker of a giant size hand operated pop corn kettle, which I bought and converted to a power driven unit. And in due time I located the makers of other mechanical apparatus suited to my needs. Then with these parts as a





Left—View of front of pop corn machine showing display compartment and general construction of cabinet. Right—View of rear showing large popper, gasoline heater with tank and material compartment at right.

But pop corn machines of the size Mr. Taylor wanted were expensive—too expensive in the estimation of a man who knows metal fabrication. So relates Mr. Taylor—

"I found that factory built jobs ranged in price from $500 to $1,750, with a model selling for $1,100 particularly striking my fancy. This machine was enclosed in a portable housing.

"Convinced that I could build the metal housing myself at no great cost, I tried to buy the popping units, but without success. The makers of a number of units were approached, and each refused to sell the units alone. Not having the $1,100, there was only one thing to do—make my own machine or give up the idea.

"For various reasons I wanted a gasoline heated, kettle-type popper. Gasoline heat is more flexible than electricity, and in a pinch can be crowded for faster popping purposes. Incidentally, the popping condition of corn varies considerably with the weather conditions, and this makes it desirable to

starting point, I built the rest of the machine around them.

"For an investment of approximately $50, I built without difficulty, a machine that is sturdier in structure, will pop more corn, is more flexible in action and cost less to operate than any power machine I know of on the market. This machine will pop ten to twelve, five-cent bags of pop corn in about four minutes, and, since four cents of every five-cent pop corn sale is profit, should have an earning capacity of from ten to twelve cents per minute, or from six to seven dollars per hour.

"A conservative sales price for the machine, I believe, is $300, or about one half the price asked for commercially produced power machines in the lower priced bracket.

"I expect to be able to offer blue prints and working instructions for building these machines, with sources of all supplies, probably at five dollars per set. More than 20 drawings are necessary to show all details."

National Advertising, Association Cooperation, Condensation, Pressure Losses, Stoker Firing, Cooling Controls, Feature N.W.A.H.&A.C. Meet

THE 1938 Mid-year convention of the National Warm Air Heating & Air Conditioning Association returned to Milwaukee, Wisconsin, after a lapse of 20 years, June 13, 14 and 15.

The Need for Publicity

Said L. R. Taylor, in his president's address—"Twenty years ago we assembled here in Milwaukee and the key topic of interest was the start of research work at the University of Illinois. Today we are here with 20 years of research work behind us. We have accomplished a great deal; far more than competing industries; and the warm air furnace and air conditioning plant of today commands the respect of all who have become familiar with modern installations.

"Therein lies our next problem—research work must go on. Perhaps more will be accomplished than in the past, for not to carry on with an increased program will soon mean oblivion. Every dollar that has been spent in the past by contributing members has been returned to them many times over. Our operating budget is small—we have often been asked how in the world so much can be done for so little. Countless thousands of hours of time have been unselfishly given by all of the committees without cost even as to actual traveling expense.

"I feel that today our problem is to let others know what we know. The time is here when we must inform the public of what we are making—what it will do for them. We want this industry for our present members—we want our trade to control the situation and not let the ones to whom it may be a sideline and who do not do business through our established trade channels come into such prominence as to represent the greatest single menace we have today. If every manufacturer, every jobber, every contractor pledged 5 cents per furnace produced or sold, at 300,000 furnaces per year—we would have an operating budget of $45,000 a year—not a large amount but a sum which would do a job of publicity. I ask for members purely because so much more can be accomplished and because the cost will actually be returned many times in increased profit."

Importance of Research

Speaking on the subject, "Importance of Research," Professor G. L. Larson, University of Wisconsin, said: "In my estimation this association owes an everlasting debt of gratitude to those who launched the association's research program. Arthur Little, in an address made some 20 years ago entitled 'The Handwriting on the Wall' and delivered just after this association's research program was inaugurated said: 'the price of progress is research.' Industrial history shows that companies and industries in receivership or in difficulty too often die because of a lack of research. Arthur Little twenty years ago cited many industries where research had been primarily responsible for practically all progress made in materials, equipment, operation and management. History also shows that research can strew your path with stones when used by competitors or can blast a way for you to succeed when you use research yourself.

"This association has established an enviable reputation as a research organization, but in spite of the progress you have made in finding ways and means of giving the home-owning public better heating and air conditioning much still remains to be done. Permit me to suggest that your research program be not allowed to die nor grow flabby and that the program be pursued with the same activity and foresight in the next twenty years as has characterized your program in the past twenty years."

Trial Publicity Campaign

A. P. Ames of Ames and Norr, a New York publicity organization, briefly outlined a preliminary demonstration publicity campaign conducted in the East among a number of newspapers and magazines. Mr. Ames declared our industry has a real story to tell. The main objective of any publicity campaign, according to the speaker, should be to make the public think of air conditioning in terms of warm air heating. "Most successful associations," declared Mr. Ames, "are organized on the basis of co-operating publicity. These organizations either have a true story to tell or see to it that a story which catches the popular fancy becomes synonymous with the name of that association. This should be the basic plan of the proposed campaign for the warm air heating industry."

Mr. Ames emphasized the importance of selling the women on any product or any idea and suggested that the association message should come through newspapers, magazines and the radio.

Mr. Ames explained how, in the demonstration campaign, a letter was mailed to building page editors of newspapers, home economic commentators on morning radio programs, and the editors of

magazines, explaining what information was available. The first response included more than 20 requests for articles from publications with above 16,000,000 circulation. As to radio, Mr. Ames declared that about three hundred stations now have a one-hour program for women in the morning. Also, that very frequently these commentators are rather hard put for interesting ideas to discuss over the air. In response to the letter explaining the sample short radio talk, 80 requests were received from stations representing a possible audience of ten to fifteen million persons.

Mr. Ames suggested that, based upon this demonstration campaign, the publicity program under discussion by the association should cover much the same ground.

Local Association Activities

J. D. Wilder, Editor, AMERICAN ARTISAN, speaking on the subject, "Some Things Successful Local Associations Are Doing," explained the impossibility of outlining all of the activities of the more than eighty associations now active in the United States, but said these activities might be grouped according to a few major activities such as—1, better trade relationships with jobbers; 2, advertising and trade relationships; 3, licensing and installation codes; 4, engineering education; 5, business problems; 6, apprentices; and, lastly, general association activities.

The speaker cited the associations in St. Louis, Milwaukee and Buffalo, New York, where the associations had solicited the active co-operation of the jobbers to the extent of setting up preferred contractor lists for credit purposes, have jointly conducted educational schools covering engineering, fabrication and estimating, and are attempting to establish a basis for more profitable operation.

Madison, Wisconsin; Oakland, California; Omaha, Nebraska, were cited as typical examples of advertising and trade relationship activities. In Madison, association members are conducting a co-operative advertising campaign in local newspapers. In Oakland, sales of gas-fired heating and air conditioning equipment were promoted by members of the Furnace Dealers and Sheet Metal Contractors Association during last summer by offering a ten per cent discount on the purchase price of equipment. In Omaha, the members of the Air Conditioning Council are using advertising and participating in local building and electric shows to promote all forms of summer and winter air conditioning.

In addition to the well-known licensing and code activities of cities like Sioux City, Iowa; Minneapolis, Minnesota; and Fort Wayne, Indiana the city of Toledo, Ohio, through the Sheet Metal & Roofing Contractors Association has perfected the existing and newly inaugurated gravity warm air heating code and is now getting ready to include a new code covering mechanical warm air heating. Akron, Ohio, is preparing to revamp its gravity code which has been in existence for some time and to include in the new ordinance provisions covering mechanical warm air heating. Both Philadelphia and Milwaukee have committees from the association actively engaged in drawing up and promoting adoption of a code for gravity and mechanical warm air heating.

Engineering education has been a basic activity of practically every organization, but the engineering schools of Philadelphia, St. Louis, and the Fox Valley in Illinois are particularly interesting at this time. In Philadelphia the school has been under way for almost two years with constantly increasing attendance and a very clearly established betterment in the general type of gravity and mechanical warm air heating systems being installed in Philadelphia. In St. Louis the jobbers and con-

As the first arrivals saw the marvelous display of food at the Mueller Furnace Company's buffet supper.

tractors have jointly set up a most comprehensive school which will cover technical engineering, fundamental principles, actual installation problems and estimating for profit. Fox Valley, in Illinois, has an engineering program under way which will probably run through the entire coming winter and through special speakers and speakers from the association will cover all points connected with both types of heating.

As business problems the situation of Elgin, Illinois, was cited, where an ordinance ready for the mayor's signature specified that no warm air furnace could be installed in any building containing more than two apartments was successfully withdrawn from the council through the efforts of the local association. In Minneapolis, despite operation under a very comprehensive licensing and installation code, prices are still too low and there is chiseling, so the Minneapolis association is making a survey of the cost of doing business for the purpose of establishing a uniform plan of selling and cost estimation. The Milwaukee association is protesting the amount of construction work going through PWA and WPA which work, according to Milwaukee contractors, ought to be let to legitimate contractors. The Cincinnati Stoker Association has successfully fought a program of free service and parts guarantee to the general betterment of the business. And the New York State association has so far been successful in preventing the appointment of a statewide licensing committee upon which there is no representation from the warm air heating industry.

Mr. Wilder closed with the suggestion that the association make a special effort to see that all of the information derived from 20 years of research should be made available to every contractor in the industry and to set up some means whereby one central organization might be established to correlate and co-ordinate all of the diversified activities now under way by the many associations.

Condensation of Moisture

Prof. L. G. Miller, Michigan State College, on the subject, "Design of Walls for Both Heat and Vapor Transfer," and using forms showing vapor transfer through insulated and uninsulated walls similar to those in the January, 1938 issue of AMERICAN ARTISAN in the article "Condensation of Moisture in Walls," said that all of the written and spoken information on vapor passage summarizes into three issues: 1, a method of analysis; 2, the quantity of vapor actually passing through a wall; 3, the supposed corrective method.

Prof. Miller suggested that in order to make the method applicable in all cases, values for the conductivity of vapor (quite generally called permeability) are required. Also, that a method of analysis might be developed in a manner similar to the development of the equation for heat transfer and the resulting equation worked out would probably follow practically the same sequence. In explanation, Prof. Miller showed how the heat conductivity coefficient of a wall and the resulting temperature drop through the various composite members of the wall are established and proposed Table 3 showing the calculation of the drop in vapor pressure through a wall of ordinary construction with loose fill insulation and the resulting dew point temperature. In terms of grains of moisture per square foot per hour—which Prof. Miller declared was somewhat new—the vapor pressure drop would look about as follows:

TABLE 3

Material	$\frac{1}{C_v}$	V.P. Drop	Vapor Press.	Dew Point
1	0		.15	45°F.
2	.033 × .308 = 0.10		.14	43°F.
5	.17 × .308 = .052		.088	31.5°F.
6	.01 × .308 = .003		.085	30.5°F.
7	.10 × .308 = .031		.054	21.5°F.
9	.143 × .308 = .044		.010	—10.0°F.
	.456			

$$U_v = \frac{1}{.456} = 2.19 \times .14 = .308 \text{ grains sq. ft./hour}$$

The values so established are plotted in Fig. 1. The fact that the temperature line and the dew

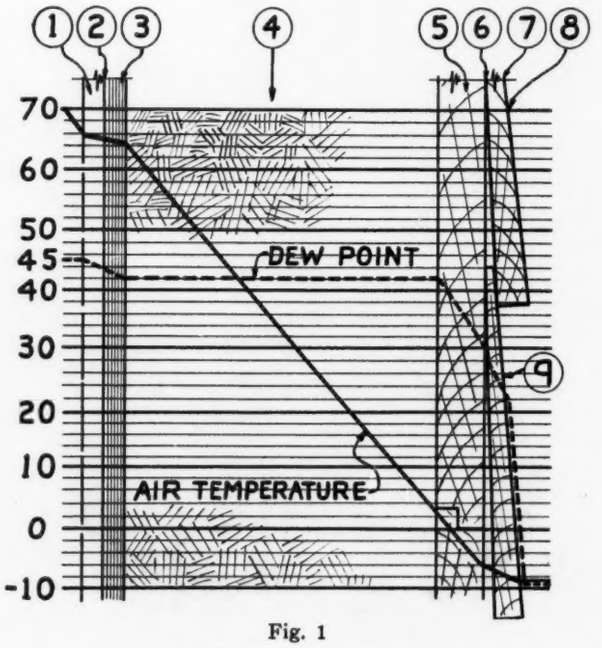


Fig. 1

point line cross inside the wall shows that condensation will occur, and if the temperature in the wall space drops below 32 deg. F., some of the vapor within the space will deposit as frost or ice. The tables calculated the same as Table 3, but for a wall having a vapor seal directly behind the plaster and transmitting not more than .4 grains of moisture per square meter per hour under a vapor pressure of 18 millimeters of mercury would show

a calculation similar to Table 4, showing .133 grains of moisture per sq. ft. per hour transmitted.

TABLE 4

Material	$\frac{1}{C_v}$	V.P. Drop	Vapor Press.	Dew Point
1	.0		.15	45°F.
2	.033	× .133 = .004	.146	44°F.
3	.6	× .133 = .080	.062	24°F.
5	.17	× .133 = .023	.0435	16.5°F.
6	.01	× .133 = .001	.042	15.5°F.
7	.10	× .133 = .013	.029	8.5°F.
9	.143	× .133 = .019	.001	—10.0°F.
	1.056			

$$U_v = \frac{1}{1.056} = .947$$

$.947 \times .14 = .133$ grains/sq. ft. per hour

In spite of the vapor seal there will still be condensation in this wall and among the suggested improvements might be a more porous sheathing, a protective covering of paint porous to vapor, but impervious to water, a more effective vapor seal under the plaster, or less insulation resulting in a temperature curve that is more convex upward. One or more of these provisions might keep the dew point entirely below the temperature line.

Quite interesting was Prof. Miller's calculation showing that where a vapor seal is used, one pound of ice per sq. ft. might form in a wall only after 35,000 hours of consecutive 10 below zero weather. Whereas, without this vapor barrier an equal amount of ice could form in about 2,000 hours or nearly three months. A solid week of ten below zero weather would produce about one-tenth of a pound of ice per sq. ft. of condensation. According to Prof. Miller, whether conditions in actual construction are severe enough to cause the conditions reported without some special aggravating cause is the subject for conjecture.

Changes in Codes

At the afternoon research session under the chairmanship of F. G. Sedgwick, Prof. Hoffman reported that Table A of the Standard Code has been revised and enlarged to correspond to Table 3 of the new Technical Code. And, in turn, both Table A and Table 3 will now have values to correspond with the values of the 1938 GUIDE. Also, that Table A in the Standard Code has been corrected to show new values for attic space temperatures and in turn Table 2 of the Technical Code has been recalculated and changed to check with the GUIDE. Prof. Hoffman reported that during the past year Table 4 has been checked; Table 5 has been enlarged to include Canadian temperatures, and the Committee is now of the opinion that the friction chart is in error in the lower friction values and that work now under way by the American Society of Heating and Ventilating Engineers will eventually result in a new friction chart showing revisions for lower velocities and for smaller pipe sizes.

Pressure Losses in Fittings

Prof. A. P. Kratz, speaking on "Pressure Losses in Elbows and Changes in Section," showed on the screen a number of the sections and fittings presented by Mr. Konzo in his article appearing in the January, 1938, issue of AMERICAN ARTISAN. According to Prof. Kratz, all codes to date have laid most emphasis on pressure losses in straight ducts, but the emphasis should be made on pressure losses in elbows and changes in sections as it is fittings of this type which establish most of the severe pressure losses and cause most of the trouble.

According to Prof. Kratz, one bad elbow at a velocity of 700 to 800 ft. per minute may show .1 inch of pressure loss or a pressure loss equal to a complete well-designed duct system. Also, one bad elbow may show a pressure loss ten times that of a good elbow.

This study of pressure losses resulting from changes in cross-sectional area in air ducts has now been compiled as Bulletin No. 300 of the University of Illinois, Engineering Experiment Station, price 65 cents. From Bulletin 300, Prof. Kratz showed a series of converging and diverging sections and abrupt expansion and abrupt contraction sections. Prof. Kratz showed air-flow through these sections, explaining how static and velocity pressure changes in these sections and turbulance is set up. This discussion of pressure losses is too complicated to be reported extensively, but it is suggested that contractors wishing complete data purchase a copy of Bulletin 300.

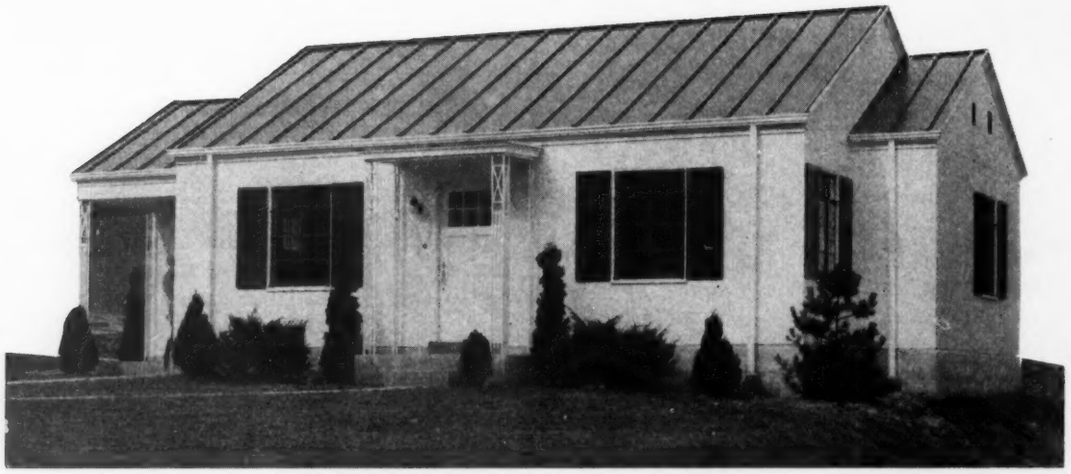
Bonnet Control Lag

Research Assistant Engdahl explained some of the reasons why a bonnet limit control does not exactly register or control bonnet temperatures. The reason is because of stratification of the air within the bonnet and, secondly, radiation from hot furnace surfaces. A third factor sometimes encountered is the lag in response on the part of the control instrument, itself. Mr. Engdahl suggested that a high bonnet should be used as often as possible as a high bonnet means better mixing of air layers and more uniform air temperatures within the bonnet. Tests show the temperature of air leaving the duct at the bonnet to be frequently 25 deg. lower than the actual setting of the control instrument. This difference is due to the effects of radiation and stratification. If possible, the limit control should be put high up in the bonnet.

Research Residence Stoker Tests

Special Research Assistant Professor S. Konzo, speaking on "Stoker Firing" described last winter's stoker tests and explained that with the same control system used on the hand-fired coal job, the stoker held the bonnet temperatures more uniformly than was secured by hand firing. Extra good hand firing—which Mr. Konzo explained was

(*Continued on page* 42)



There is nothing "modernistic" in the appearance of this house. Low cost is obtained from standardized, factory-made sections. Low maintenance is assured by the all metal construction. Comfort is obtained from insulated walls, ceilings and roof. The details opposite show construction.

A Low Cost, All-Steel House

THE first Blaw-Knox, all-steel, experimental home at 114 Pennsylvania Avenue, Clairton, near to the new Irvin Works of the Carnegie-Illinois Steel Corporation, is designed to be a contribution to the development of a low-cost home, at no sacrifice of good materials, good workmanship, proper insulation, comfort and appearance, all so essential for a present-day dwelling.

The house, of colonial design with a gabled roof, is 44 feet 2 inches wide by 24 feet 2 inches deep, containing approximately 900 square feet exclusive of porches. A variety of designs using standard steel panels permits a wide range of planning for four, five or six room homes.

All steel, fire-safe construction, which is termite proof and provides a high degree of insulation as well as a low cost, has been employed. The house has been built on a foundation of concrete blocks resting on concrete footings carried below the frost line. The floor is laid on a reinforced four-inch concrete slab using 2-inch by 4-inch wood sleepers spaced 16 inches on centers. With the exception of the utility room, which has a concrete floor troweled smooth and level with the other floors, all are of yellow pine, sanded, stained, and varnished; the floors of the kitchen and bath are covered with standard linoleum.

An outstanding feature of the Blaw-Knox home is in the exterior walls which are constructed of standard size, insulated panels of wall height. These are made in pre-fabricted units either 40 inches or 20 inches wide, so that complete flexibility of design within the limits of the employment of these units is possible.

The panels consist of a steel frame of rust-resisting copper-bearing steel channels welded together. The interior and exterior surfaces of the panels are then covered with metal clad, one-inch water-proof rigid insulation, thus forming an enclosed three-inch air space. The panel is then completed with copper-bearing, formed steel sheets laminated to the insulation with a rust-inhibitive asphalt emulsion cement.

The fabricated panels are delivered ready for erection, with a shop coat of metal priming paint, and provide a smooth finish for both interior and exterior walls without the use of exposed bolts, welding or screws.

No cutting is required to form windows or doorways, as all panels are fabricated to the exact size required and can be quickly erected with special connectors furnished.

The walls rest on a foundation sill or base angle of copper-bearing galvanized steel, which is attached to the foundation with ⅜ by 6-inch bolts. A ⅛-inch asphalt felt weather strip is cemented to the under side of the base angle to form a seal next to the foundation.

All the interior partitions are constructed of channel studs placed 16 inches on centers with channel wall caps and floor plates; both faces of the partitions are covered with ⅜-inch sheet rock, using reinforced metal "A" joint system and crack filler.

The roof framing consists of double steel channels welded together. The truss members are bolted together, cross braced, and bolted to the heavy

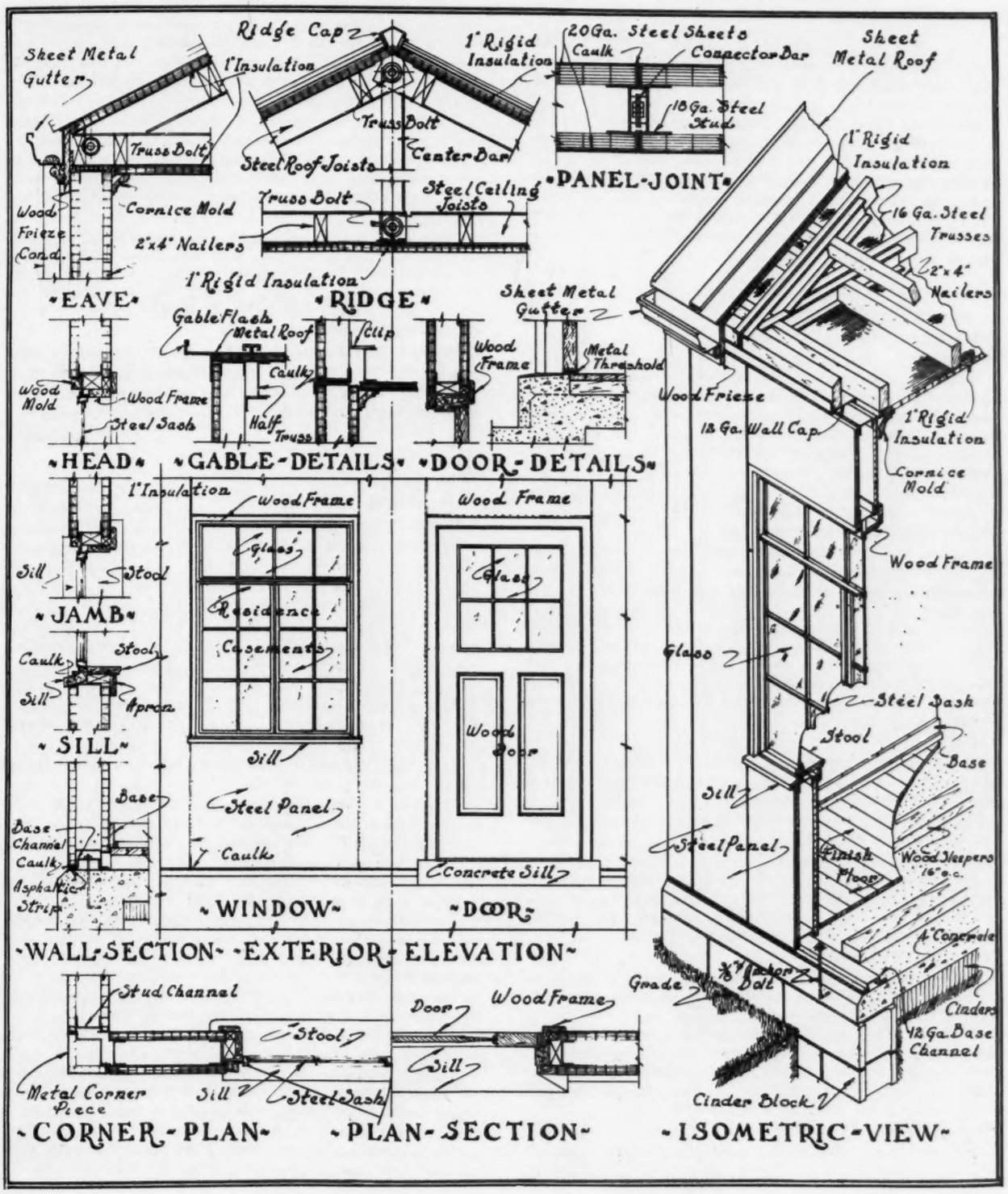
gauge top plates of the side walls. They are designed to carry maximum loads on clear spans of 24 feet.

The bottom chords of the trusses provide the support for the metal clad insulated ceiling panels which are attached with clip brackets and Helyx nails.

All roof surfaces are completely insulated with one-inch asphalt impregnated rigid structural insulation attached to roof, trusses, and cross bracing.

The roof covering is of galvanized standard seamed panels. Special design of the ridge, ridge cap, and panel caps, provides an absolutely watertight roof.

The design of wall and roof construction has been conducted to give a maximum of insulation to provide homes warm and easy to heat in winter and cool and comfortable in the summer. With a double thickness of one-inch rigid structural insulation board, separated by an air space on the outside walls and one-inch insulation on both ceilings and roofs, an insulation rating of about .10 is attained compared to a conventional frame or brick veneer construction of about .25.



Your comment or experience is invited.

PROBLEM CORNER

Protecting Woodwork

American Artisan:

How close to unprotected woodwork may a portable warm air furnace be placed when it is installed as a gravity job? How close may it be installed for a forced air and air conditioned job?

My reason for asking for this information is that our city is attempting to modernize its building code and as chairman of the committee of heating men appointed by the building inspector to help with this project, I have been unable to get specific information covering this particular point. I have written several places, but the information received does not cover the placement of furnaces in relation to woodwalls.

R. F. R., Idaho.

Reply by
The Editors

It has been necessary to check back through the various codes which we have on file and as a general answer to your question, we did not find any specific recommendations for what you call a portable furnace and the insulation necessary for nearby wood construction.

If it will be of any assistance, we quote from several codes which contain specifications which may be considered comparable to your portable furnace.

FORT WAYNE, INDIANA

Section 25: "No warm air pipe shall run within 1" of any woodwork unless such woodwork or the pipe is covered with asbestos paper weighing not less than 12 pounds per 100 sq. ft."

Section 25d: "Any furnace, the casing top of which shall come within 12" of a combustible floor, ceiling or joist, shall be protected by a metal shield extending not less than 18" beyond the casing. This shield shall be suspended at least 2" below woodwork, allowing free air space between shield and woodwork."

CHICAGO

Section I (3): "Should any smoke pipe come within 18" of any combustible material, such combustible material must be covered with asbestos paper and a metal shield so fastened that a 2" air space exists between the shield and the combustible material."

MONTCLAIR, NEW JERSEY

Section 5, Article 2: "Warm air pipes leading from the furnace to wall stacks shall not be placed nearer than 1" of woodwork unless such woodwork is covered with asbestos paper and the paper covered with tin or iron."

SIOUX CITY, IOWA

Section 3, Item g: "In no case shall the top casing of a furnace be allowed nearer than 24" of any combustible ceiling or joist above the furnace."

Section 4, Item b: "No warm air pipe within 8' of the furnace, except when doubled, shall be placed within 2" of any woodwork unless such woodwork is covered with asbestos paper covered with tin or iron with an air space of 1" between the metal and the wood."

DES MOINES, IOWA

Section 423.3: "Should any smoke pipe come within 12" of any combustible material, such combustible material must be covered with asbestos paper and a metal shield so fastened that a 2" air space exists between this shield and combustible material."

Section 424: "Whenever room heaters are supported by legs not less than 5" high, they may be set on a combustible floor, but the floor under the heater shall be covered with non-combustible material extending not less than 12" on sides and back of heater and 36" in front of heater."

MINNEAPOLIS, MINN.

Specifications are practically identical with Fort Wayne, Indiana. This code does state "Any casing or top coming closer than 6" to a combustible ceiling or joist shall be provided with at least 1½" of magnesia or equivalent incombustible insulation in addition to the metal shield."

TOLEDO, OHIO

These specifications identical with Minneapolis and Fort Wayne.

◆

"Best" Set of Books

American Artisan:

Will you please suggest the best set of books for a small sheet metal shop to use. I am thinking of some kind of an accounting record book which can be used to enter all the data necessary for the government—state and national.

C. O. P., Indiana.

Reply by
J. G. Dingle,
Ottawa, Ill.

We note you are entering into a partnership enterprise—to operate a small furnace and sheet metal shop, and wish advice on bookkeeping and Social Security.

During 1930, the American Artisan carried a series of articles on Bookkeeping, in which I discussed the problems of a shop such as yours, and presented the necessary forms, journals, and accounts. You, perhaps, do not have available these old copies of the Artisan. I find I have a copy of the issue of October 25, 1930, which I am sending you under separate cover. You will find, on pages 36, 37 and 38 illustrations showing the following forms.

Cost Sheet.—Used to accumulate data as to material and labor costs for each job.

Material Ticket.—On which is recorded material as it is taken from stock into job construction.

Time Card.—To be filled out by the workmen showing jobs worked on, time on each job, each day.

The material ticket and time card are the source of information to be posted to the Cost Ticket.

Cash Journal.—This journal is provided for the purpose of recording the receipt and disbursement of cash, and as will be seen provides suitable columns for sorting these transactions.

Purchase Journal.—To be used in recording purchases, also providing a means of noting date of payment.

Sales Journal.—Used to classify sales as between labor and materials.

General Journal.—In which to make general entries, such as arise from time to time.

In the July 3, 1930, issue of the Artisan, appeared a list of the accounts which, in our opinion, are necessary to properly handle a typical shop. I am sending you my copy of this issue, and hope you will find it instructive.

The Problem Corner . . .

Chimney Insulation

American Artisan:

I am figuring an air conditioning job for a home owner in the neighborhood of Amsterdam, N. Y. The house is over 100 years old with a stone foundation 22 in. thick. It is now heated by stoves.

The present chimney is too small for a furnace, the owner's plan is to build another at the north side of house. It will be a cold spot as the prevailing wind for that section is west and north when the temperature reaches 35 deg. There may be no velocity to the flue gases by the time they reach the top, even though they start off with good intentions.

The base of this chimney ought to start from rock. I believe this is not far below cellar bottom. The furnace people call for a 9 x 12-inch flue.

Would it be advisable to band this chimney to cellar wall, then step it away from clapboard—say 4 in.—rather than lay it close to siding. How much ought this to be spread at base? How about leaving a clear space between inside of brick and outside of flue lining of two or three inches at each joint. Make a solid diaphragm of cement two inches thick, filling the complete space, fill the space between these diaphragms with rock wool, or Zonolite, as both are good insulators—fireproof and waterproof. Ought this increase the draft so chimney will not cool off so rapidly?

The base of this house where furnace will be located will have a clear space of 6 ft. 8 in. under floor joist, 6 ft. 0 in. under center girder beam. The fire ordinance calls for a clearance of 2 ft. 0 in. between smoke flue and any combustible material. This would mean the smoke pipe would enter chimney through wall 4 ft. 8 in. above finished floor.

F. W. S., New Jersey.

Reply by
L. W. Millis, Secretary,
Security Stove & Mfg. Co.,
Kansas City, Mo.

I do not know how large the furnace is to be. In order to make a positive statement, I should know the diameter of the grate and the number of pounds of coal, or quantity of other fuel, per square foot of grate per hour.

Also I should know how high the chimney will be. It should be about three feet above the ridge of the roof. It is not necessary to build the chimney in such an expensive manner as your letter indicates. I would not build with an air space between the building and the chimney. Nor would I leave an abnormal space between the flue lining and the bricks. You will find it difficult to do so without chopping up a lot of bricks.

The main thing is for the flue to be absolutely tight and smooth inside. In building the chimney be sure every joint between the tiles is grouted and "struck off" on the inside to keep it smooth. I would grout what little space there is between the tile and the bricks so that any air that might, now or in the future, leak through the brick portion or the top of flue, could not possibly leak into the inside of the tile.

If the house is of frame, I would suggest cutting the outer shell, if feasible, and let the chimney recess into the building. Probably the worst feature you have is the low basement. The smoke pipe should be devoid of elbows or tees, or as nearly so as possible, and should have an elevation of not less than one inch per foot of length. In your case if the smoke pipe must be quite long it is advisable to increase it one size in diameter. Of course, you will provide for expansion and contraction of the smoke pipe. You should use every precaution to prevent air from leaking into the smoke pipe.

Some inspectors will permit a smoke pipe to be very much closer than the ordinance calls for, provided the wood work is protected by metal shields suspended between the wood work and the smoke pipe. The shield should be one and one-half or two inches away from the wood work and the same distance from the smoke pipe. That allows the shield to absorb the radiant heat from the smoke pipe while the surrounding air dissipates this heat into the air.

If the inspector allows it, you could use a double shield, but arrange to have air circulate so it wipes all the surfaces of the shield. Insurance people love asbestos paper. It might be well to cover the shields with asbestos paper.

In addition to these suggestions I will add that a furnace with a large grate can burn less pounds of coal per square foot of grate than a furnace with a smaller grate. Therefore, a fire with less depth of fuel can be used and will not require as strong a draft as a furnace that requires a deep bed of coal.

I am writing this from experience based on a large number of "weak" chimneys. I am sure the chimney I have outlined will serve your purpose. Your worst problem is the low basement; you could overcome that by setting the heater in a pit.

Reply by
S. Konzo

I note that you are confronted with the problem of building a new chimney for an old house. After studying your problem I would make these few comments:

(1) There is no question that the base of the chimney should start from the rock foundation.

(2) The 9 x 12 flue which is suggested by the furnace installer seems adequate unless the house is more than approximately 15 rooms in which case I would go to a larger chimney.

(3) As I understand the problem it is one of tying in this new chimney to the house. I am not sufficiently acquainted with building practices to specify the dimensions for the base of the chimney. In general I would be inclined to follow the usual custom in building outside chimneys of getting a foundation that is approximately twice as wide as the upper portion of the chimney. Since the chimney is built into the structure, I would be inclined to band it wherever there is something secure to tie into.

(4) Your suggestion in regards to insulating the chimney seems a good one and should assist in preventing excess heat loss from the surfaces.

Reply by
H. A. Daniel,
Atlas Roofing Co.,
Newburgh, N. Y.

In regard to the chimney I would advise against building it with a space between the chimney and the house because it will add an extra side to lose heat and thus retard the draft.

I believe if you remove the siding and the roof sheathing and build the chimney just outside the outer line of the studs you will have no difficulty if you will line this chimney with flue lining all the way up.

I do not believe it will be necessary to insulate between the lining and the brick. However, if you choose to wrap each joint of the lining with two layers of aircel asbestos wrapped around the joint and wired on before the brick work is built up outside of the lining, it will do no harm.

Where the ends of the siding boards meet the chimney it would be advisable to put a flashing in behind each siding board extending 3" behind the board and 2" out on the chimney.

These flashings should be built in with each row of boards. Then a cap flashing can be nailed vertically to make a neater appearance than the separate flashings would make, and also to keep the water from driving in.

Technique For Resistance Welding Ferrous and Non-Ferrous Sheet Metals*

By E. I. Larsen
P. R. Mallory & Co., Inc., Indianapolis

A GREAT many papers have dealt with various phases of resistance welding. Most of these papers, however, have been of a general nature or have dealt with one or two specific problems relating to resistance welding or the welding of some particular alloy or metal. The present paper is more or less in the nature of a correlated abstract covering the more important aspects of resistance welding of all of the important ferrous and non-ferrous alloys now being welded.

In the preparation of this paper the author has taken a great deal of published data from various sources.

As is well known by those connected with the use of resistance welding to fabricate sheet metals there are a great many variables. Some of these variables can be changed over wide ranges without affecting to any great extent the quality of the resulting weld. The data, therefore, presented in this paper are not guaranteed to be those which will produce the most satisfactory results on any or all welding operations. It is thought they are more or less average and will give the reader an idea as to the correct ranges in which to work.

General

Welding is a combination of heat supplied by electric current (Joule heat) and pressure used for joining together two or more pieces of metal. The welding process itself has its basis in the recrystallization of the metal. The pressure required in the process serves several purposes:

1. It presses the surface of the metals close together.
2. It breaks through the films of oxides, nitrides and adsorbed gases that are found on the surface.
3. It provides a small deformation in the crystals of the original metal that will permit them to recrystallize during the welding operation. During this process of recrystallization the grains may grow across the interfaces that separated the two pieces. As this grain growth occurs, the two pieces are welded together.

In the welding of certain non-ferrous metals it is necessary to actually melt the metal in the interfaces in order to produce the recrystallization which causes the two pieces to be welded.

Welding Heat

(a) **Electrical Conditions.**—The amount of heat generated depends upon the current flowing through the pieces to be welded and the resistance of the surface contact areas. This can usually be explained as follows:

Heat in Kilo-Calories $= 0.238 \times R \times I^2 \times T \times 10^{-3}$

R = resistance
I = current
T = time
0.238 = conversion factor (1 Joule = 0.238×10^{-3} Kilo-Calories)

The resistance consists of the following three parts: (1) Resistance between electrode and work. (2) Resistance between the two sheets to be welded. (3) Specific resistance of the sheets.

The resistance of items one and two depends upon the pressure used. The following other factors enter into the resistance: (1) Surface condition of the material (rough, smooth, scaly, etc.) (2) Shape and size of the electrode. (3) Electrode material. (4) Surface condition of the electrodes.

From the above it is evident that the shape, size, surface condition and chemical composition of the electrodes and the pressure on the electrodes must be adjusted to suit certain types of metal and certain surface conditions of the material to be welded. If the material to be welded has an electrical conductivity much lower than that of the electrodes most of the heat will be generated between the pieces to be welded. If, however, the material to be welded has a higher electrical conductivity than the electrode material then heating will occur also at the point where the electrode is in contact with the work and the welding face of the electrode may stick to the sheet.

In order to retain the highest possible electrical conductivity in the electrode material it is necessary that efficient water cooling be used, otherwise the electrical conductivity will decrease due to increased temperature. This is true for copper and copper base alloys and as an example the values for pure copper are given below:

Table I

Temperature		Per Cent
Centigrade	Fahrenheit	Electrical Conductivity
20	68	100
100	212	75
200	392	58
300	572	50
400	752	43
500	932	35

*Paper presented before American Welding Society in Cleveland, Ohio, October 21, 1936.

The thermal conductivity of copper decreases less rapidly as is evident from Table 2.

The thermal conductivity shown in Table 2 applies, however, only to pure copper as in most of the copper base alloys now used for resistance welding electrodes the thermal conductivity increases slightly with the temperature rise obtained during most resistance welding operations. As an example, the thermal conductivities of some commercial alloys are listed in Table 3.

Table 2

Temperature		Thermal Conductivity
Centigrade	Fahrenheit	Cal./cm.²/cm./sec./deg. C.
20	68	0.912
100	212	0.901
200	392	0.890
300	572	0.879
400	752	0.867
500	932	0.856

Table 3

Material	Thermal Conductivity Cal./cm.²/cm./sec./deg. C. 20° C. (68° F.)	200° C. (392° F.)
Elkaloy	0.824	0.841
Mallory 3	0.820	0.827
Mallory 53	0.403	0.487
Mallory 73	0.245	0.280
Elkaloy D	0.18	0.23

(*b*) *Thermal Calculations.*—It is necessary that the cylindrical volume inclosed between two electrodes be raised to the welding heat. The heat required can be calculated from the following equation:

$$\text{Kilo-Calories} = \frac{d^2\pi}{4} \times 2s \times g \times T_w \times C$$

d = Diameter of electrical tips
s = sheet thickness
g = specific gravity
c = specific heat
T_w = welding heat

The term $\frac{d^2\pi}{4} \times 2s \times g$ indicates the weight of the cylinder which is inclosed between the two eelectrodes. If this weight is multiplied by the specific heat and the welding temperature then the heat necessary for the welding can be calculated from the above formula. In addition to the calculated heat certain losses occur which must be taken into consideration.

(1) Conduction of the heat by the electrode. This is proportional to the electrode tip area multiplied by the temperature difference between the welding point and the electrode temperature and is also proportional to the length of time the electrodes are in contact with the work.

(2) Conduction by the welded sheets. This heat loss depends upon the diameter of the electrode tip and on the thickness of the sheet. It depends also on the temperature difference of the work, the weld heat and room temperature.

(3) Radiation losses. In Table 4 are given some of the more important properties of materials commonly welded.

Capacity of Welders

Any given size or capacity of welder is capable of handling a wide variety of stock thickness but there are many factors and conditions to be taken into consideration. Some of the factors governing this are: (1) Gage or thickness of sheet; (2) composition of material to be welded; (3) condition of material itself, whether clean, scaly, rough, etc.; (4) welding speed; (5) length of welder arms and distance between arms.

The shape of the job to be welded has an important effect on the output capacity of the welder. If steel extends into the throat of the welder this may act as a field choke thus reducing the secondary or welding current.

Table 4

Material	Electrical Resistivity Microhm²/cm.	Electrical Conductivity % of Copper	Thermal Conductivity Cal./cm.²/cm./sec./deg. C.	Specific Heat Cal. 1%	Spec. Grav.	Melting Point °C.
Aluminum ..	2.83	60	0.504	0.214	2.71	660
Copper	1.724	100	0.918	0.092	8.9	108.3
Nichrome ...	1.06	1.63	0.025	0.107	8.17	1390
Monel	50	3.45	0.05	0.127	8.80	1350
Lead	22	7.8	0.083	0.031	11.35	327
Armco Iron.	10	17.2	0.161	0.107	7.86	1535
Zinc	6	28.5	0.265	0.093	6.7	420
Phos. Bronze	10	17.2	0.12	0.087	8.9	1050
Brass	9	19.1	0.22	0.094	8.40	935
Nickel Silver	33	5.2	0.07	0.094	8.45	1100
Nickel	10	17.2	0.142	0.105	8.86	1450
Stain. Steel..	70	2.5	0.04	0.118	7.86	1400
Everdur	26	6.7	0.078	0.093	8.46	1019

Timing Devices

It has been found that short and accurately controlled timing with correspondingly high welding current results in superior welding which in many instances is otherwise impossible. This is because correct timing, especially when short, is the one factor most difficult to control with the usual welding equipment and, therefore, requires special timing devices. The most important factors in weld timers are: (1) accuracy, (2) flexible timing adjustment, (3) timers should operate direct from line voltage and (4) low maintenance cost.

Timing has become of particular importance in the welding of such materials as: (1) very light gage sheets, (2) dissimilar metals or alloys, (3) metal of high thermal conductivity, (4) stainless steels, (5) special alloys and (6) aluminum alloys and aluminum.

General Spot Welding Electrode Requirements

(*a*) *Electrical and Heat Conductivity*

It is essential that the electrical conductivity of a spot welding electrode be sufficiently high so that

under correct operating conditions of pressure, etc., heating will occur at the joint of the materials to be welded and not between the electrode face and the stock to be welded; otherwise sticking of the electrode may occur. It is important that the heat conductivity be good so that the electrode can dissipate the heat generated during the welding operation.

(*b*) *Tensile Properties*

The yield point of electrode materials is important in resistance welding because the electrode material will flow plastically during the welding operation. The ability of the material to retain a reasonably high yield point at slightly elevated temperatures is important because of the rise in temperature to which the electrode face is subjected.

(*c*) *Electrode Design*

The design of a spot welding electrode will have a great deal to do with the life of the electrode during operation. As has been pointed out by investigators there is almost an unlimited number of designs of electrodes possible. In many cases the design will be dictated by the type of work to be welded. Very often, however, it is possible to make improvements by allowing for better heat distribution and heat dissipation in the solid metal parts of the tip.

(*d*) *Cooling*

Practice has shown the enormous importance of water cooling of spot welding electrodes. By this means alone the life of spot welding electrodes can be increased considerably because the temperature of the metal is kept below the annealing or recrystallization point. Some electrodes have been designed so that the water cooling has been brought to within a small fraction of an inch of the welding face; in other tips the cooling has been kept quite a distance away from the welding face. In some designs the water hole has been made so large that only a shell of the electrode remains. As is usual in most engineering problems a compromise is necessary.

(*e*) *Welding Pressure*

Another important factor in resistance welding and particularly with reference to the life of spot welding electrodes is the welding pressure. These pressures may vary from 5,000 lb. per sq. in. to values as high as 50,000 to 60,000 lb. per sq. in. according to the type of material welded. If the welding pressure is maintained at a value higher than the yield point of the electrode material then the electrode will flow plastically or "mushroom." If this would occur at room temperature the cold work would harden the metal. In most cases, however, the temperature is near the softening point and no beneficial but rather detrimental effects result.

Table 5

METALS	ALUMINUM	ASCOLOY	BRASS	COPPER	GALVANIZED IRON	IRON	LEAD	MONEL	NICKEL	NICHROME	TIN PLATE	ZINC	PHOS. BRONZE	NICKEL SILVER
ALUMINUM	○										○	○		
ASCOLOY		○	○	○	○	○		○	○	○	○		○	○
BRASS		○	○	○	○	○		○	○	○	○	○	○	○
COPPER		○	○	○	○	○		○	○	○	○	○	○	○
GALVANIZED IRON		○	○	○	○	○	○	○	○	○	○		○	○
IRON		○	○	○	○	○		○	○	○	○		○	○
LEAD					○		○				○	○		○
MONEL		○	○	○	○	○		○	○	○	○		○	○
NICKEL		○	○	○	○	○		○	○	○	○		○	○
NICHROME		○	○	○	○	○		○	○	○	○		○	○
TIN PLATE	○	○	○	○	○	○	○	○	○	○	○		○	○
ZINC	○		○	○			○					○		
PHOS. BRONZE		○	○	○	○	○		○	○	○	○		○	○
NICKEL SILVER		○	○	○	○	○	○	○	○	○	○		○	○

(*f*) *Fundamental Requirements of Spot Welding Electrodes* are high hardness, high yield point and high annealing temperature combined with high electrical and heat conductivity. The important property seems to be the ability of a welding electrode to retain its hardness and proportional limit at elevated temperatures.

In Table 5 are shown materials and combinations of material which can be successfully spot welded.

[To be continued]

N. W. A. H. & A. C. Conventon

(*Continued from page* 35)

practically an impossibility in the average residence —brought up the overall results to a point just about the equal of stoker operation.

Mr. Konzo pointed out that the over-fire draft, in other words, the slide in the fire door which admits air directly over the fire, had a very noticeable effect upon the overall operation. With the over-fire damper open, inefficient combustion resulted on the off-cycles of the stoker, in other words, when the stoker was not running, too much air was admitted to the combustion chamber. When the firedoor damper was closed, more efficient combustion resulted. One interesting result was the fact that with the stoker a lower bonnet temperature resulted, although this bonnet temperature was more uniform, with the final result that the fan ran for longer periods and this in turn brought about more uniform house conditions.

To bring the effect of the overfire damper home more clearly, Mr. Konzo said that at a 40-deg. temperature difference between indoors and outdoors, the coal consumption was 135 pounds with the overfire door closed, 160 pounds by careful hand firing, and 180 pounds with the overfire door open. Flue gas temperature tests and CO_2 checks also showed better results with the overfire door closed.

Also interesting was the test which showed that at 40-deg. temperature difference between indoors and outdoors, the stoker averaged four hours of oper-

(*Continued on page* 79)

RESIDENTIAL AIR CONDITIONING SECTION

IN this month's section will be found part one of the Research Residence test report on cooling with a mechanical condensing unit 40 per cent undersized according to previous cooling tests. The mechanical unit was supplemented by night air cooling and approximately one air change per hour during the day for ventilation.

In the first tests, all rooms in the house were cooled simultaneously. In the second tests, the first story was cooled in the daytime; the second floor rooms after 6:30 p. m. The conclusions will be presented in Part 2, in August.

We begin publication, also, of a two-part article covering current practices in installing attic ventilating fans for elimination of noise, prevention of vibration, compliance with local fire ordinances, and all-around operating satisfaction. The data and drawings have been drawn from contractors, manufacturers' manuals and actual trouble jobs.

HOW WOULD YOU HAVE HANDLED THIS AIR CONDITIONING PROBLEM ?

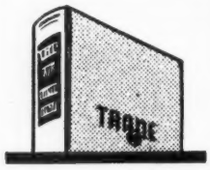
VARIATIONS in weather made fixed production schedules impossible in the Calcasieu Bakery at Lake Charles, La. When bread was set to cool, no one knew whether one hour would be required or five.

To step up production, a new plant was planned which would have room for additional machines; a ventilating system was figured for the new building. The total investment would have been $11,800.

As an alternate, an air conditioning system was figured for the old building, based on the Trane Large Capacity Commercial Air Conditioner. Price, complete with compressor, duct work, and incidentals, $3,500. The Trane System was selected.

Note the interesting results:

1. A strict production schedule was made possible.
2. Product became more uniform, meeting legal requirements of weight and moisture content in a more economical way.
3. They produced a better loaf in keeping qualities, freedom from mold, texture, and appearance of crust and moisture content.
4. There was a saving of $8,300 as a direct result of solving the problem with Trane equipment.
5. Production was increased 20%, without adding new machines or floor space
6. All loss was eliminated in the dough-room, from drying out or crusting.



Have you ordered your Trane Air Conditioning Manual yet? Press and public agree that this 325 page volume is a great contribution to the air conditioning industry. Price $5.00, with order, postpaid in the U.S.

• • •

THE Trane Commercial Air Conditioner, illustrated above, is only one of many units produced by Trane for commercial, process, and comfort work. Applications vary from the feather-weight (30-pound) heating system for the famed China Clipper, to the huge air conditioning network built to order for Chicago's great Palmer House.

The complete Trane Heating, Cooling, and Air Conditioning Line is merchandised for installation by the local contractor, based upon specifications by the architect and consulting engineer. Cooperation through 70 branch offices in U.S.A., or write direct to the main office at 2007 Cameron Ave., La Crosse, Wis.

• • •

The Symbol (AIR) is used exclusively by Trane to Signify the Nth degree of excellence in Heating, Cooling, and Air Conditioning Equipment.

TRANE

THE TRANE COMPANY (AIR) LA CROSSE, WISCONSIN

Also TRANE COMPANY OF CANADA LTD., TORONTO, ONTARIO

Unit Heaters · Specialties · Convectors · Climate Changers · Cooling Coils · Unit Coolers · Blast Coils · Unit Ventilators

Study of Summer Cooling in the Research Residence Using a Small Capacity Mechanical Condensing Unit‡

By A. P. Kratz*, S. Konzo**, M. K. Fahnestock***, and E. L. Broderickt (MEMBERS)
Urbana, Ill.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the *National Warm Air Heating* and *Air Conditioning Association* and the University of Illinois.

THE previous investigations in summer cooling in the Research Residence during the summers of 1932 to 1936 inclusive made use of central cooling plants of approximately 30,000 Btu per hour capacity, employing either ice, mechanical refrigeration, or cold water. The investigation for the summer of 1937 was undertaken to determine the temperature and humidity conditions that could be maintained in the Research Residence with a mechanical condensing unit having a capacity approximately 40 per cent less than the 30,000 Btu per hour previously used; particularly when such cooling was supplemented by the circulation of outdoor air through the house at night, and when approximately one air change per hour of outdoor air was used for the purpose of ventilation during the day.

In the first series of tests (Series 1-37) made during the summer of 1937, cooled air was distributed to the rooms on both the first and second stories when the indoor air conditions were such that cooling was required. However, in the second series of tests (Series 2-37) the cooled air was delivered only to the rooms on the first story during the daytime, and only to the rooms on the second story after 6:30 p. m.

Description of the Research Residence and Cooling Equipment

The Research Residence together with the forced-air heating system has been described in a previous paper.[1] For the purpose of this investigation the Residence was equipped with awnings at all east, south, and west windows, and the sunroom was isolated from the rest of the house by closing the doors leading into the dining room. The entire third story was regarded as an attic and during the daytime was isolated from the rest of the house by closing the door at the head of the stairs. The attic windows, however, were opened to provide ventilation in the attic both day and night. The total space cooled amounted to 14,170 cu ft. Unless otherwise specified, the state of the Residence was the same as that during previous summers.

With the exception that the duct leading to the kitchen register was connected to the south trunk duct which supplied air to the first story rooms only, the arrangement of the forced-air duct system and fan was practically the same as that used in previous summers. For the first series of tests (Series 1-37), in which both the first and second story rooms were cooled at the same time, the dampers in the ducts to the first and second stories were adjusted to maintain the proper balance between the amounts of air required for cooling on these two stories. For the second series of tests (Series 2-37), in which the first story rooms were cooled until 6:30 p. m., and the second story rooms were cooled after 6:30 p. m., a damper arrangement was installed in the bonnet of the furnace casing so that the circulating air could be distributed either entirely through the registers on the first story or entirely through the registers on the second story.

The arrangement of the cooling plant is shown in Fig. 1. The condensing unit was self contained and consisted of a water-cooled shell and finned coil condenser-receiver, and a two-cylinder motor-driven compressor. Cooling was accomplished by direct expansion of dichlorodifluoromethane in an evaporator placed in a by-pass in the central cold air return duct. The evaporator, or cooling coil, consisted of finned copper tubing placed two rows deep in the direction of air flow and nine rows high measured along the vertical axis of the air duct. The tubes were ¾ in. outside diameter and had fins, eight to the inch, which were continuous strips of sheet metal extending from the top row to the bottom row of tubes. The evaporator as installed in the duct was 14⅝ in. high and 20⅜ in. wide, and the gross, or face, area presented to the flow of air was 2.07 sq ft, while the net, or free, area was 1.02 sq ft. The nominal capacity of the condenser and evaporator units under the conditions of actual operation at a compressor speed of 255 rpm, with return refrigerant temperature of 55 F, inlet water temperature of 59 F, ambient air temperature of 74 F, and with an air velocity of approximately 479 fpm across the 2.07 sq ft of face area, was 16,300 Btu per hour.

*Research Professor, Engineering Experiment Station, University of Illinois.
**Special Research Assistant Professor, Engineering Experiment Station, University of Illinois.
***Research Assistant Professor, Engineering Experiment Station, University of Illinois.
†Research Assistant, Engineering Experiment Station, University of Illinois.

[1]Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 95).

‡Presented at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Hot Springs, Va., June, 1938.

The controls employed consisted of a thermostatic expansion valve having the thermostatic bulb clamped to the suction line near the junction with the evaporator; a pressure operated water control valve, used to regulate the flow of water through the condenser; and a room thermostat, located in the hall on the second story. The latter served to start and stop the compressor in accordance with the cooling load required to maintain constant room temperature.

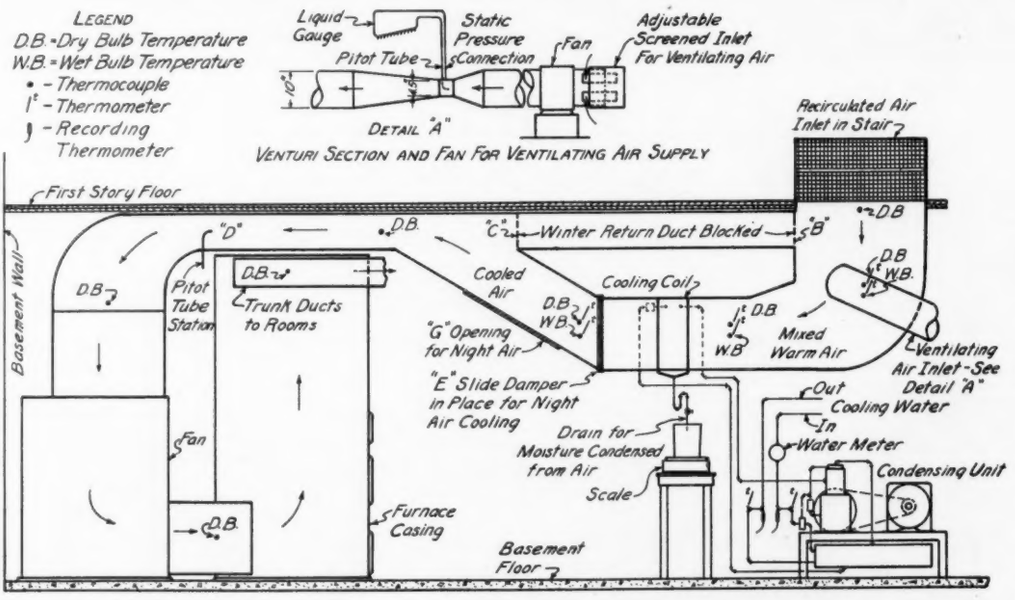


Fig. 1—Diagram of cooling plant with mechanical refrigeration

The cooling coil was installed in a by-pass in the central return duct, as shown in Fig. 1. For the summer work, the duct was blocked at B and C, and all of the air delivered to the fan in the forced-air system passed through the cooling coil when the air in the house was being recirculated. For the purpose of providing outdoor air for cooling during the night, a slide damper, E, was placed in the by-pass on the outlet side of the coil, and a door, G, was placed in the recirculating duct on the down-stream side of the slide damper. When outdoor air was required, the basement door and the door, G, in the recirculating duct were opened, and the slide damper, E, was closed. The fan in the forced-air system delivered approximately 1000 cfm of air when recirculating the air in the house and 2220 cfm when using outdoor air at night. These air volumes were based on an air density of 0.075 lb per cubic foot. Outdoor air, for the purpose of ventilation during the day, was provided by means of the duct shown as Detail A in Fig. 1.

The study of the heat flow through exposed west and north walls was made in the northwest bedroom of the Research Residence. Two Nicholls heat-flow meters[2] were installed, one on the west wall and one on the north wall, with the centers at an approximate height of 33 in. above the floor. The wall section consists of lap siding, building paper, sheathing, studding space, wood lath and plaster with rough sand finish. The coefficient of heat transmission for this uninsulated wall section is 0.25 Btu per square foot per hour per degree Fahrenheit, at a wind velocity of 15 mph. A thin felt pad was placed over the plaster wall and the heat-flow meter was fitted tightly against the felt pad by means of a wooden frame, as shown in Fig. 2. A complete set of 17 thermocouples, in addition to those incorporated in the heat-flow meters, was installed so that air temperatures and surface temperatures both underneath and adjacent to the heat-flow meters could be obtained.

[2]Measuring Heat Transmission in Building Structures and a Heat Transmission Meter, by P. Nicholls (A.S.H.V.E. TRANSACTIONS, Vol. 30, 1924, pp. 65-104).

Method of Conducting Tests

Continuous records were made during the summer of air temperatures in the various parts of the house and in the different sections of the duct system. A complete description of the measurements which were made has been given in a previous report.[3]

During the periods of operation, observations were made of the weight of water circulated through the condenser, the temperatures of the water entering and leaving both the condensing unit and the house, the head and suction pressures, and the electrical inputs to the compressor and fan motors.

During all of the tests the windows in the attic remained open and those on the first story remained closed. For the purpose of cooling with outdoor air at night, the attic door and 11 windows on the second story were opened in the evening when the effective temperature outdoors became equal to the effective temperature indoors. The dampers were set and the basement door opened, so that the fan delivered outdoor air through the duct system until 7 a. m. The fan delivery was 2220 cfm or 9.4 air changes per hour. The windows and doors were closed at 7 a. m. and the dampers were changed so that the fan started delivering recirculated air and the outdoor air admitted for ventilation. The former was equivalent to 3.2 recirculations of the air in the house and the latter was equivalent to one air change per hour, making a total of 4.2 air changes per hour delivered by the fan. The fan was allowed to run continuously during the day and night.

In the first series of tests, which has been designated as Series 1-37, when the effective temperature of the indoor air on the second story rose to about 75 deg,

[3]Study of Summer Cooling in the Research Residence Using Water from the City Water Mains, by A. P. Kratz, M. K. Fahnestock, S. Konzo, and E. L. Broderick (A.S.H.V.E. TRANSACTIONS, Vol. 42, 1936, p. 193).

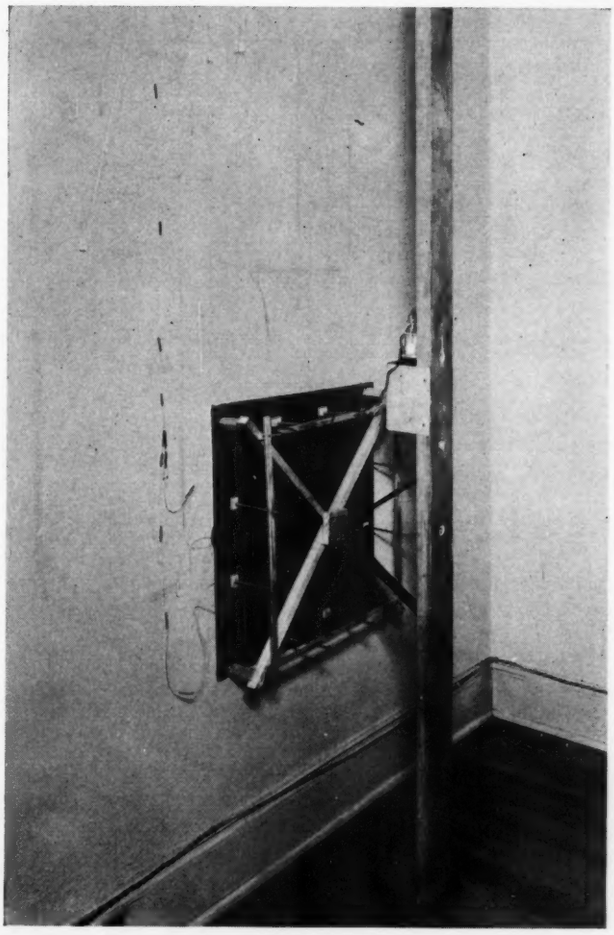


Fig. 2—Heat-flow meter installation on north wall

giving an average of approximately 74.5 deg for both stories, the condensing unit was started, and cooled air was distributed to the rooms on both stories. At the start of the test, when the relative humidity indoors was from 60 to 75 per cent, the corresponding dry-bulb temperature was from 79 to 78 F. The cooling plant was allowed to operate intermittently with the thermostat set to maintain approximately 78 F. However, the heat absorbing capacity of the unit was so small that when the rooms on both stories were being cooled the plant operated practically continuously until the time when cooling with outdoor air at night was started.

In the second series of tests, designated as Series 2-37, the recirculated air was distributed only to the first story rooms after 7 a. m., and the condensing unit was operated intermittently, maintaining an effective temperature of about 74 deg until 6:30 p. m. At that time the dampers were set so that all of the cooled air was distributed only to the second story rooms. Cooling with outdoor air at night was started when the effective temperature outdoors became equal to the effective temperature of the second story rooms.

Temperatures and heat flow measurements at the heat-flow meter installation were made at regular intervals, both day and night, for a period of 29 days. The data were plotted on a continuous chart and this chart was used as a basis for the analysis of results.

Results of Tests with Simultaneous Cooling on Both Stories

General Conditions

The operating characteristics of the cooling plant and a comparison of the actual and calculated cooling loads for the house can best be illustrated by the results obtained on a typical day. For this purpose the test made on September 1, 1937 was selected as typical of the operation obtained when the rooms on both stories were cooled (Series 1-37), and the results are shown in the first column of Table 1 and in Fig. 3. General results from all the tests are given in Table 2.

On the day which was selected as being typical for the tests made under conditions of operation for Series 1-37, the outdoor temperature was 89.3 F at 2 p. m. and reached a maximum of 91.0 F at 4 p. m. In this connection it is of interest to note that the maximum outdoor dry-bulb temperature for the entire season of 1937 was 95 F. The season was considerably cooler than the previous summer season, which was the hottest summer occurring in Urbana, Ill., since the year 1888, when the local Station of the U. S. Weather Bureau was established.

The air conditions at different locations are given in Items 5 to 15 of Table 1. The temperature of the cooled air leaving the registers was approximately 72.0 F. The rise in temperature of the air passing through the furnace casing and ducts was 3.3 F.

The cooling studies made during previous summers[4] had indicated that complete temperature traverses in the duct on both sides of the coil were required in order to obtain the proper corrections to be applied to the averages of the temperatures obtained from the wet- and dry-bulb thermometers at the two reading stations on each side of the coil. The distribution between the sensible and latent heat loads, as shown in Item 22, Table 1, was obtained by using the corrected values for the dry-bulb temperatures, and by multiplying the weighed amount of condensation from the coil by a constant representing the heat given up by the change in moisture content of the air per pound of water vapor condensed. The value of the constant amounted to 1050 Btu per pound of vapor condensed.

Operating Characteristics

The operating characteristics with cooled air supplied to the rooms on both stories are shown in Fig. 3. The second story windows had been open during the night previous to this test from 9:15 p. m. to 7 a. m., and outdoor air had been circulated by means of the basement fan. On this test the condensing unit operated intermittently from 9:07 a. m. to 11:30 a. m., and continuously from 11:30 a. m. to 10:07 p. m. maintaining the dry-bulb temperature between 77.0 F and 79.5 F.

At the start of the test at 9:07 a. m. the indoor relative humidity was 80 per cent and the indoor effective temperature was 75.5 deg. After the condensing unit had operated for about an hour the relative humidity decreased to 70 per cent with an accompanying effective temperature of 73.6 deg. However, during the off-period of the cooling unit both the relative humidity and ef-

[4]Loc cit. Note 3.

Table 1—Typical Operating Data and Results Obtained With Small-Sized Condensing Unit on August 17, and September 1, 1937

1. Date	9-1-37	8-17-37	8-17-37
2. Test No	25	19	19
3. Series	1-37	2-37	2-37
4. Time of Day	2:00 p. m.	3:30 p. m.	7:30 p. m.
5. Outdoor Air			
Dry-Bulb, F	89.3	92.8	80.3
Wet-Bulb, F	74.3	75.8	71.3
Dew-Point, F	68.2	69.1	67.5
Relative Humidity, per cent	50.0	46.0	65.0
Specific Humidity, grains per pound dry air	103.8	107.0	101.2
6. Indoor Air, average breathing level temp.			
1st Story, F	78.4	78.1	79.4
2nd Story, F	78.1	83.0	81.0
7. Indoor Air, average at breathing level	Both Stories	1st St.	2nd St.
Dry-Bulb, F	78.2	78.1	81.0
Wet-Bulb, F	69.0	66.7	68.8
Dew-Point, F	64.6	60.7	63.0
Relative Humidity, per cent	62.9	55.0	54.0
Specific Humidity, grains per pound dry air	91.6	79.6	86.0
8. Indoor Air, entering return grille			
Dry-Bulb, F	78.0	76.6	79.2
Wet-Bulb, F	69.0	68.1	68.8
Dew-Point, F	64.8	63.9	63.8
Relative Humidity, per cent	64.0	64.8	59.0
Specific Humidity, grains per pound dry air	92.1	89.2	88.8
9. Ventilating Air			
Dry-Bulb, F	88.1	90.1	79.9
Wet-Bulb, F	75.1	74.1	72.7
Dew-Point, F	69.9	67.4	69.7
Relative Humidity, per cent	55.0	47.5	71.0
Specific Humidity, grains per pound dry air	110.4	101.0	109.6
10. Mixed Air, entering cooling coil			
Dry-Bulb, F	79.8	79.5	78.7
Wet-Bulb, F	70.2	69.7	69.4
Dew-Point, F	66.0	65.2	65.1
Relative Humidity, per cent	62.5	61.5	63.0
Specific Humidity, grains per pound dry air	95.8	93.4	93.2
11. Mixed Air, leaving cooling coil			
Dry-Bulb, F	68.7	67.2	67.3
Wet-Bulb, F	64.5	62.8	63.4
Dew-Point, F	62.3	60.3	61.2
Relative Humidity, per cent	82.0	78.5	81.0
Specific Humidity, grains per pound dry air	84.2	78.4	81.2
12. Air Temp. drop through cooling coil, F	11.1	12.3	11.4
13. Temp. cooled air leaving registers, average, F	72.0	70.5	72.0
14. Air Temp. rise in ducts and casing, F	3.3	3.3	4.7
15. Basement Air Temp. at breathing level, F	74.2	74.8	74.2

16. Quantity of air through wet coil	Both Stories	1st St.	2nd St.
Cubic feet per minute	978	916	958
Pounds per hour	4,400	4,120	4,310
Density of air, pounds per cubic feet	0.075	0.075	0.075
17. Number of air recirculations per hour	4.1	7.8	8.0
18. Ventilating Air			
Cubic feet per minute	231	228	229
Pounds per hour	1,040	1,026	1,032
Density of air, pounds per cubic feet	0.075	0.075	0.075
19. Cooling Coil			
Gross Face Area, square feet	2.07	2.07	2.07
Net Free Area, square feet	1.02	1.02	1.02
20. Air Velocity through Coil			
Gross Face, feet per minute	473	443	463
Free Area, feet per minute	959	898	940
21. Moisture condensed from air, pounds per hour	6.16	5.47	5.95
22. Heat given up by air; total Btu per hour	18,190	17,900	18,050
Heat due to moisture in air			
Btu per hour	6,470	5,740	6,250
Per cent of total heat	35.5	32.0	34.6
Sensible heat			
Btu per hour	11,720	12,160	11,800
Per cent of total heat	64.5	68.0	65.4
23. Water Temp. in condenser			
Inlet, F	59.7	59.8	59.5
Outlet, F	102.7	101.8	101.4
Rise, F	43.0	42.0	41.9
24. Water Temp. in house			
Inlet, F	59.5	59.6	59.5
Outlet, F	102.7	101.5	101.0
Rise, F	43.2	41.9	41.5
25. Quantity of cooling water			
Pounds per hour	448	442	451
Gallons per hour	53.7	53.1	54.1
26. Heat absorbed by cooling water, Btu per hour			
Through condenser	19,260	18,560	18,900
Through house	19,350	18,520	18,710
27. Refrigerant pressures			
Suction pounds per square inch	40	39	40
Discharge pounds per square inch	131	130	129
28. Nominal Rating of condensing unit with 55 F return refrigerant, 59 F condensing water and 74 F ambient air, Btu per hour	16,300	16,300	16,300
29. Compressor Speed, revolutions per minute	255	255	255
30. Compressor Motor Data			
Size, horsepower	2	2	2
Measured power rate, Kilowatt	1.37	1.34	1.34
31. Fan Speed, revolutions per minute	451	451	451
32. Fan Motor Data			
Size, horsepower	¾	¾	¾
Measured power rate, Kilowatt	435	440	440

fective temperature increased to values of 75 per cent and 75.3 deg respectively. This alternate decrease and increase of relative humidity and effective temperature was characteristic of the intermittent operation of the cooling plant. This characteristic was also observed in the case of the previous plants that had been installed in the Research Residence. A more detailed discussion of this condition is presented in a later section of this paper. The indoor comfort conditions during the intermittent periods of plant operation were on the upper border-line for comfort and could be regarded as reasonably satisfactory.

When the plant operated continuously, as from 11:30 a. m. to 10.07 p. m., the relative humidity stabilized at about 59 per cent, representing an effective temperature of 74 deg. The indoor conditions during these periods of continuous operation could be considered as entirely satisfactory. It is of interest to note that the minimum values of the indoor relative humidity that were maintained were approximately 10 to 15 per cent greater than those maintained during the tests made in the season of 1934 with a condensing unit having a heat absorbing capacity of practically 30,000 Btu per hour. To the extent that a relative humidity of 45 per cent might possibly be considered as slightly more desirable than a relative humidity of 59 per cent, even for the same effective temperature, the indoor conditions maintained with the larger condensing unit may be considered as slightly more favorable than those maintained with the smaller condensing unit.

It may be noted that in order to maintain the same effective temperature a unit having a smaller capacity should be operated to maintain an indoor dry-bulb temperature somewhat lower than that to be maintained with a unit having a larger capacity. This fact, together with the advisability of allowing for a rise in the indoor temperature on hot days when the cooling plant was insufficient in capacity to maintain a constant temperature, made it advisable to operate the smaller plant from a room thermostat which was set at approximately 78

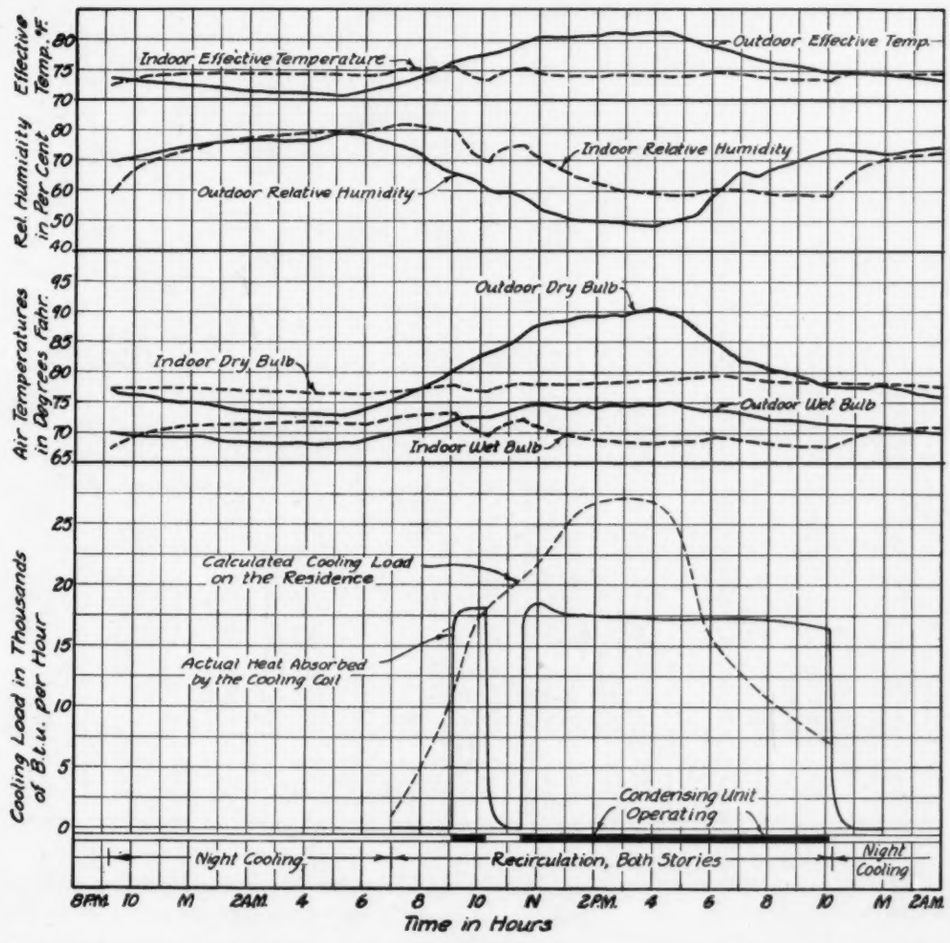

Effective Temp. °F
Indoor Effective Temperature
Outdoor Effective Temp.
Rel. Humidity in Per Cent
Indoor Relative Humidity
Outdoor Relative Humidity
Air Temperatures in Degrees Fahr.
Outdoor Dry Bulb
Indoor Dry Bulb
Outdoor Wet Bulb
Indoor Wet Bulb
Cooling Load in Thousands of B.t.u. per Hour
Calculated Cooling Load on the Residence
Actual Heat Absorbed by the Cooling Coil
Condensing Unit Operating
Night Cooling
Recirculation, Both Stories
Night Cooling
8PM. 10 M 2AM. 4 6 8 10 N 2PM. 4 6 8 10 M 2AM.
Time in Hours

Fig. 3—Actual and calculated cooling load on Residence and air temperatures. Test No. 25, Series 1-37, September 1, 1937

F rather than 80 F. The differences in the relative humidities that were obtained have been attributed partly to the difference in seasons, partly to the difference in the mean coil temperatures and partly to the difference in the depth of the coils in the two plants. A complete discussion of the observed relationship between the mean coil temperatures and the relative humidity in the house has been presented in a previous paper.[5]

Limitations in Cooling Capacity

The cooling capacity of 17,300 Btu per hour was found to be sufficient for days in which the maximum outdoor temperature rose to 95 F and the minimum outdoor temperature during the night preceding the test did not exceed 71 F. Since the summer season was relatively cool, no tests were obtainable under severe weather conditions in which the outdoor temperature exceeded 95 F. From Fig. 3 it may be observed that during the period of continuous operation the indoor dry-bulb temperature gradually rose from a value of 78.1 F at 1 p. m. to a value of 79.5 F at 6 p. m. The indoor effective temperature at 6 p. m. was 74.8 deg which was just on the border-line for comfort. It is probable that if the outdoor air had been materially hotter the rise in the indoor temperature would have been greater and the indoor effective temperature would probably have been above that represented by the upper limit of the comfort zone. In the following section an analysis is presented of the limitations of the small condensing unit when used under all weather conditions and with the method of operation employed in the Research Residence.

In a previous study[6] of the effect of methods of night operation on conditions in the Residence on the following day, it was shown that the maximum indoor temperature that was attained during the day was dependent not only on the maximum outdoor temperature, but also on the minimum outdoor temperature that existed during the night previous to the test. For example, the maximum indoor air temperature of 81 F would result during the day, succeeding a night of operation with a given type of fan, if under upper limiting conditions a maximum outdoor temperature of 93.6 F was preceded by an outdoor minimum temperature of 62.0 F; and if under lower limiting conditions a maximum outdoor temperature of 83.6 F was preceded by an outdoor minimum temperature of 71.0 F. The same conditions could also be obtained with any maximum temperature lying between these limits when accompanied by a proper corresponding outdoor minimum temperature. It may be noted from this example that the average of the maximum and minimum outdoor temperature, or the daily median temperature, required in each case to result in the 81 F indoor air temperature was practically the same. This was also true of all of the daily median temperatures obtained from the intermediate combination of outdoor maximum and minimum temperatures required to result in this same indoor temperature. It is reasonable to expect, therefore, that the maximum indoor air temperature that is attained on a given day would bear some relation to the daily median temperature.

That such a relationship exists is shown by the data plotted in Fig. 4. These data were obtained during the summer of 1937 and show the maximum indoor tem-

[5]Study of Summer Cooling in the Research Residence Using Water at Temperatures of 52 F and 46 F, by A. P. Kratz, S. Konzo, and E. L. Broderick (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, May and June 1937, pp. 319-327 and 391-400).

[6]Investigation of Summer Cooling in the Warm-Air Heating Research Residence, by A. P. Kratz, M. K. Fahnestock, and S. Konzo (*University of Illinois Engineering Experiment Station Bulletin*, No. 290, January 1937, pp. 73-80 and Fig. 25).

Table 2—Complete Data and Results for Tests

Date 1937	Test No.	Series No.	Weather Data: Degree-Hours Above 85 F	Degree-Hours Above 90 F	Total Sunshine in Hours and Minutes	Outdoor Air: Maximum Temp. During Test F	Minimum Temp. Previous to Test F	Average Temp. During Period Requiring Cooling: Temp. F	Hum. Per Cent	Indoor Air Conditions: At End of Night Cooling: Temp. F	Hum. Per Cent	Average During Period Requiring Cooling: Temp. F	Hum. Per Cent	Temperature Difference: Outdoor Max. to Average Indoor F	Average Outdoor to Avg. Indoor F
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7–6	1	1a–37	19.4	0	15:00	89.0	65.0	84.3	47.9	73.7	71.0	79.5	54.0	9.5	4.8
7–7	2	1a–37	34.9	0.3	14:49	90.0	67.0	87.0	48.1	75.3	68.5	79.3	51.6	10.7	7.7
7–8	3	1a–37	19.0	0.1	7:15	90.0	75.0	86.4	50.2	76.4	69.6	78.7	58.9	11.3	7.7
7–9	4	1a–37	19.6	0	9:47	90.0	69.0	85.2	58.0	75.4	78.5	79.0	59.6	11.0	6.2
7–10	5	1a–37	45.1	4.0	13:07	91.0	70.0	87.9	56.8	77.1	79.4	79.4	58.0	11.6	8.5
7–11	6	1a–37	11.5	0	13:07	86.0	71.0	84.4	63.2	77.8	75.5	79.2	59.3	6.8	5.2
7–12	7	1a–37	2.1	0	5:32	84.0	70.0	79.0	72.0	77.8	74.3	78.9	66.3	5.1	0.1
7–14	8	1–37	23.6	0	14:28	88.0	68.0	86.0	66.9	76.4	87.3	79.6	65.0	8.4	6.4
7–15	9	1–37	22.6	0	10:55	88.0	73.0	86.1	62.6	78.3	78.8	79.8	61.2	8.2	2.7
7–16	10	1–37	25.6	0	11:18	89.0	72.0	86.2	58.4	78.0	78.1	79.7	59.9	9.3	6.5
7–24	11	1–37	16.6	0	7:58	88.0	67.0	85.9	57.8	75.0	70.5	78.6	59.7	9.4	7.3
8–4	12	1–37	0.0	0	1:35	83.0	68.0	80.7	72.9	75.4	74.6	79.0	72.1	4.0	1.7
8–6	13	1–37	1.0	0	11:48	85.0	68.0	82.5	58.8	73.8	68.3	78.5	60.0	6.5	4.0
8–7	14	1–37	33.9	0.7	14:07	91.0	65.0	87.5	56.4	73.8	74.1	79.1	65.3	11.9	8.4
8–9	15	1–37	0.6	0	6:46	88.0	68.0	83.3	60.7	76.1	81.8	78.8	61.4	9.2	4.5
8–10	16	1–37	13.3	0	10:10	90.0	66.0	84.3	60.9	74.4	75.5	79.1	60.6	10.9	5.2
8–11	17	1–37	35.6	0.6	9:40	91.0	70.0	87.8	58.0	76.5	77.0	79.7	62.0	11.3	8.1
8–16	18	1–37	35.5	1.2	13:47	94.0	65.0	85.9	55.6	73.1	71.9	79.2	60.5	14.8	6.7
8–17	19	2–37	47.1	12.8	11:34	95.0	72.0	86.7	55.4	77.2	77.9	78.6	59.6	16.4	8.1
8–18	20	2–37	19.4	0	8:42	91.0	68.0	86.7	59.4	75.3	63.3	78.5	66.6	12.5	8.2
8–19	21	2–37	27.0	0	13:40	92.0	71.0	86.5	50.6	76.1	73.5	78.8	59.2	13.2	7.7
8–20	22	2–37	21.0	0	12:41	90.0	67.0	84.7	59.3	75.4	68.5	78.7	61.2	11.3	6.0
8–30	23	2–37	12.6	0	9:51	91.0	68.0	83.2	59.4	75.6	73.0	78.5	61.0	12.5	4.7
8–31	24	1–37	6.7	0	6:15	87.0	69.0	83.7	60.4	76.2	76.1	77.7	63.3	9.3	6.0
9–1	25	1–36	27.1	0.3	8:45	92.0	72.0	85.2	58.6	77.0	81.6	78.1	66.5	13.9	7.1
9–2	26	1–37	23.6	0	8:35	91.0	72.0	85.7	53.9	77.2	78.8	78.8	60.5	12.2	6.9
9–3	27	1–37	12.6	0	9:57	89.0	70.0	84.2	58.6	76.4	80.2	78.1	62.0	10.9	6.1
9–4	28	1–37	0.5	0	5:15	87.0	72.0	81.3	65.6	77.0	78.3	77.6	65.2	9.4	3.7

peratures that were obtained when cooling was accomplished only by the use of outdoor air at night, and the condensing unit was not operated. The points representing these data are shown as circles in Fig. 4 and a full line is shown drawn through the points. It may be observed that for a daily median temperature of 75.5 F the maximum indoor temperature was 79.0 F.

The points representing the data obtained for the maximum indoor temperature when the small-sized condensing unit was operated are indicated by crosses, and a broken line drawn through the points represents the average. The intersection of the broken line with the full line is of particular significance as representing a critical daily median temperature, since it shows that for all values of the daily median temperature exceeding 75.5 F some amount of artificial cooling was required, and that for all values less than 75.5 F cooling with outdoor air at night alone was sufficient to maintain suitable indoor conditions. For example, for a daily median temperature of 83 F, if night air cooling alone was used, the indoor temperature would have risen to approximately 84 F; whereas if the small-sized condensing unit had been operated with the room thermostat set at 78 F, the indoor temperature would not have exceeded 80 F.

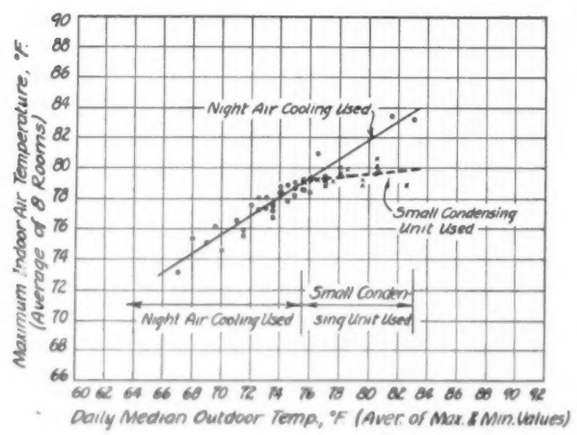


Fig. 4 — Relationship between indoor temperature and daily median outdoor temperature

The daily median temperature of 83 F, which was exceeded only once during the cooling season of 1937, may be considered as the probable upper limit for the range of application of the small-sized condensing unit. It is most probable that for daily median temperatures exceeding 83 F, the indoor temperatures would have risen above 80 F and the comfort conditions would not have been entirely satisfactory during the entire day. This is indicated by the fact that the broken line in Fig. 4 intersects the 80 F maximum indoor temperature line at a point corresponding to a daily median temperature of approximately 83 F. However, even with these higher outdoor temperatures, the resulting indoor conditions would have been much more acceptable than if no cooling had been used. Additional data under extreme weather conditions are desirable in order to investigate the actual resulting indoor comfort conditions.

From a statistical study of the daily median temperatures for a given season in Urbana, Ill., the number of days on which satisfactory indoor conditions would result, either from the use of air from outdoors at night or by supplementing such cooling with the use of the small condensing unit, can be determined by employing

Table 2—Complete Data and Results for Tests (Cont'd)

Operation of the Fan						Overall Test Period			Compressor Operation					Total Moisture Condensed Lb	Heat Absorbed by Cooling Coil During Overall Test Period Btu			Ratio Moisture to Total Load
Night Air Cooling Previous to Test		Recirculation Previous to Test		Recirculation During Test Period		Start of Cooling with Condensing Unit to Start of Night Air Cooling			Time in Hours	Power Input Kwhr	Condenser Water							
											Quantity in Gallons	Temperature						
Duration Hours	Power Kwhr	Duration Hours	Power Kwhr	Duration Hours	Power Kwhr	Start	End	Duration Hours				Inlet F	Rise F		Load Due to Moisture	Sensible	Total	
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
11.50	5.7	9.95	4.2	3.05	1.5	4:57 pm	8:00 pm	3.05	3.05	4.6	193	58.9	42.9	14.02	14,720	42,350	57,070	0.258
11.00	4.9	8.78	2.8	6.72	3.1	1:47 pm	8:30 pm	6.72	6.72	10.3	418	58.8	42.5	34.14	35,850	93,900	129,750	0.276
10.50	4.8	5.00	2.1	4.25	2.0	12:00 M	4:15 pm	4.25	3.52	5.7	223	58.9	42.3	24.66	25,890	46,750	72,640	0.356
14.75	6.8	5.50	2.2	7.50	3.5	12:30 pm	8:00 pm	7.50	6.28	10.1	416	59.0	42.1	47.31	49,680	76,150	125,830	0.395
11.00	5.0	3.28	1.3	12.22	5.4	10:17 am	10:30 pm	12.22	12.22	19.1	816	58.9	41.8	92.18	96,790	153,500	250,290	0.387
8.50	3.8	3.68	1.7	11.32	5.0	10:41 am	10:00 pm	11.32	11.32	17.9	757	58.9	41.3	84.70	88,940	140,900	229,840	0.387
9.00	4.1	2.50	1.0	7.50	3.3	9:30 am	5:00 pm	7.50	3.68	5.8	246	59.1	41.7	29.84	31,330	44,000	75,330	0.416
10.10	4.4	5.07	2.3	10.20	4.4	12:04 pm	10:16 pm	10.20	10.20	13.8	600	59.2	41.4	80.66	84,690	100,300	184,990	0.458
8.73	3.9	1.73	0.9	12.27	5.3	8:44 am	9:00 pm	12.27	12.27	16.3	713	59.4	41.0	87.61	91,990	126,800	218,790	0.421
10.00	4.6	2.63	1.1	12.12	5.4	9:38 am	9:45 pm	12.12	12.12	16.1	684	59.1	41.4	73.85	77,540	133,100	210,640	0.368
10.67	4.8	6.87	2.9	5.00	2.3	2:17 pm	7:17 pm	5.00	5.00	6.7	268	59.3	42.0	27.23	28,600	52,550	81,150	0.353
11.83	5.2	10.93	4.9	1.27	0.7	5:56 pm	7:12 pm	1.27	1.27	1.8	603	59.5	42.0	9.52	10,000	14,900	24,900	0.402
13.25	5.9	9.77	4.3	2.65	1.1	4:46 pm	7:25 pm	2.65	2.65	3.5	139	59.3	43.1	14.07	14,770	31,150	45,920	0.322
11.58	5.2	6.87	3.0	6.22	2.9	1:52 pm	8:05 pm	6.22	4.85	6.6	262	59.5	42.4	29.21	30,680	53,200	83,880	0.366
12.42	5.5	7.18	3.3	5.32	2.2	2:11 pm	7:30 pm	5.32	5.32	7.2	299	59.5	41.1	31.04	32,620	61,100	93,720	0.348
11.50	5.5	8.25	3.4	5.50	2.3	3:15 pm	8:45 pm	5.50	5.25	7.0	286	59.6	42.2	30.07	31,580	62,500	94,080	0.336
10.25	4.6	5.00	2.2	8.25	3.6	12:00 M	8:15 pm	8.25	8.25	11.3	459	59.4	42.7	52.44	55,100	91,300	146,400	0.377
12.17	5.5	8.50	3.7	4.50	2.0	3:30 pm	8:00 pm	4.50	4.50	5.9	244	59.5	42.3	25.72	27,000	52,900	79,900	0.338
11.00	5.1	3.08	1.2	11.92	5.3	10:05 am	10:00 pm	11.92	10.53	14.1	569	59.6	41.9	58.89	61,820	122,100	183,920	0.336
9.00	4.2	5.50	2.3	5.00	2.1	12:30 pm	5:30 pm	5.00	2.68	3.6	151	59.4	42.4	15.34	16,110	30,300	46,410	0.347
13.50	6.0	5.25	2.3	8.00	3.6	12:15 pm	8:15 pm	8.00	5.57	7.5	297	59.5	42.2	25.06	26,300	69,600	95,900	0.274
10.75	4.9	5.50	2.3	8.58	3.8	12:30 pm	9:05 pm	8.58	5.78	7.8	318	59.9	42.0	32.81	34,480	63,650	98,130	0.352
11.50	5.7	7.15	3.0	7.10	3.1	2:09 pm	9:15 pm	7.10	5.17	7.0	275	59.8	42.6	27.89	29,290	60,100	89,390	0.328
9.75	4.4	3.00	1.3	11.25	4.9	10:00 am	9:15 pm	11.25	11.00	15.0	586	59.4	43.2	69.29	72,750	123,000	195,750	0.372
9.75	4.5	2.12	0.8	13.13	5.7	9:07 am	10:15 pm	13.13	11.75	15.7	633	59.4	43.6	72.75	76,390	130,300	206,690	0.370
8.75	4.5	2.17	0.9	11.25	4.9	9:10 am	8:25 pm	11.25	11.08	14.9	592	59.4	43.1	62.45	65,600	128,400	194,000	0.338
10.58	4.9	3.00	1.2	12.00	5.2	10:00 am	10:00 pm	12.00	11.00	14.6	590	59.3	43.2	66.29	69,600	124,000	193,600	0.360
9.00	4.0	2.50	1.1	6.50	2.8	9:30 am	4:00 pm	6.50	6.00	8.0	324	58.9	43.3	40.90	42,950	61,400	104,350	0.412

the data shown in Fig. 4. Such a study has been applied to a season represented by the average of 11 seasons extending over the years of 1927 to 1937 inclusive and the results are shown in Table 3. This table shows a summary of the total number of days during the 11 year period for which the daily median temperatures assumed the values indicated. The data shown are for the total 1683 days included in all of the seasons between May 1 and September 30 (153 days per season) for the 11 years, and represent mild as well as severe summers. It may be noted that a daily median temperature of 75.5 F was obtained about 85 times during the 11 year period, averaging about eight days per season; whereas a daily median temperature of 83.0 F occurred 26 times during the 11 year period, or an average seasonal frequency of 2.4 days.

The data in Table 3, showing the average number of days during a season on which a given daily median temperature was attained, have been represented graphically in the upper part of Fig. 5. The broken line represents a mean of the points plotted. The values indicated on the right hand ordinate show the frequency in terms of percentage of the number of days in a season comprised of 153 days.

The lower curve in Fig. 5, representing the total number of days in the season having daily median temperatures not exceeding the value shown on the abscissa, was obtained by integrating the area under the curve included between the vertical ordinates of the origin and the stated value in the upper part of Fig. 5. It may be noted, for example, that for approximately 108 days in the total season of 153 days, the daily median

Table 3—Distribution of Days Corresponding to Indicated Values of the Median, or Average of the Outdoor Maximum and Minimum Temperature

(*Data based on* 1683 *days included between May* 1 *and September* 30 *for years* 1927 *to* 1937, *inclusive.*)*

Daily Median Temperature, F	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
No. of Days in 11-year Period	1	1	0	1	2	1	5	3	9	6	10	8	18	22	17	14	20	22	29	28	28	36	37	38	62	44	45	47
Avg. No. of Days per Season	0.09	0.09	0	0.09	0.18	0.09	0.45	0.27	0.82	0.55	0.91	0.73	1.64	2.00	1.55	1.27	1.82	2.00	2.64	2.55	2.55	3.27	3.36	3.45	5.64	4.00	4.09	4.27

Daily Median Temperature, F	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
No. of Days in 11-year Period	77	55	64	67	93	81	67	81	89	72	64	46	50	53	41	26	23	18	25	5	13	6	4	2	5	1	1	0
Avg. No. of Days per Season	7.00	5.00	5.82	6.09	8.45	7.36	6.09	7.36	8.09	6.55	5.82	4.18	4.55	4.82	3.73	2.37	2.09	1.64	2.27	0.45	1.18	0.55	0.36	0.18	0.45	0.09	0.09	0

*Data from Urbana, Ill. Station of United States Weather Bureau.

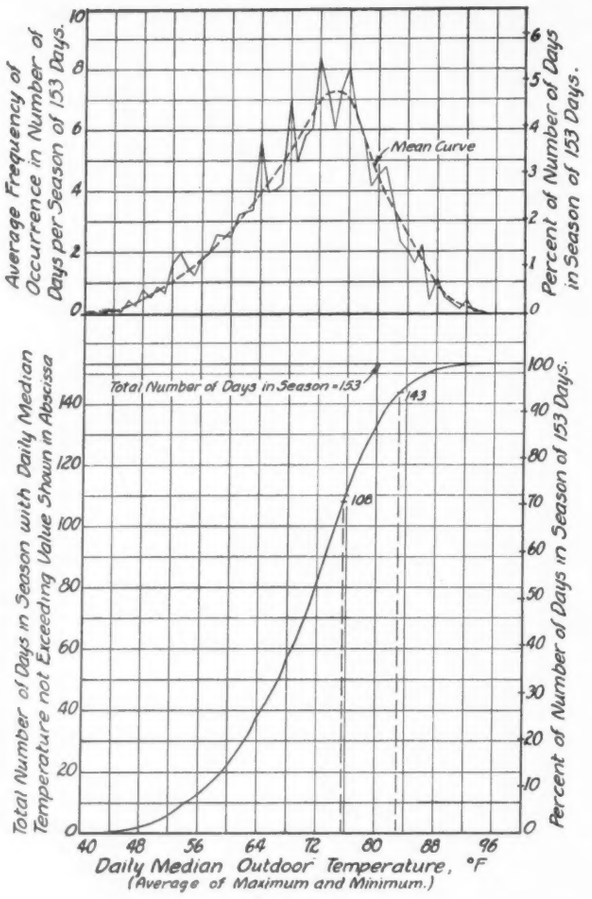

Average Frequency of Occurrence in Number of Days per Season of 153 Days.
Percent of Number of Days in Season of 153 Days.
Mean Curve
Total Number of Days in Season = 153
143
106
Total Number of Days in Season with Daily Median Temperature not Exceeding Value Shown in Abscissa
Percent of Number of Days in Season of 153 Days.
Daily Median Outdoor Temperature, °F
(Average of Maximum and Minimum.)

Fig. 5—Frequency of occurrence of days having stated daily median temperatures

temperature would be less than 75.5 F. The latter was indicated in Fig. 4 as representing a critical or limiting daily median temperature. Hence Fig. 5 indicates that cooling with air from outdoors at night alone would be sufficient to maintain comfortable conditions in the Research Residence for 108 days, or 70.6 per cent of the average season of 153 days; but would not be adequate for the remaining 45 days.

Similarly Fig. 5 indicates that for approximately 143 days in the season, the daily median temperature would not exceed the 83.0 F shown in Fig. 4 as the upper limit for the small condensing unit. That is, the small condensing unit, when used in connection with cooling with outdoor air at night by means of the basement fan, would be sufficient to maintain desirable comfort conditions in the Residence on 143 days, or 93.4 per cent of the season, but would not be sufficient in capacity to prevent the indoor temperature from exceeding 80 F on 10 days. These data represent a typical average season only, and considerable deviations from the average may occur during any given season. For example, during the relatively mild season of 1937 the daily median temperature exceeded 83.0 F on only one day; whereas during the extremely severe summer season of 1936, the daily median temperature exceeded 83.0 F on 28 days. Furthermore, the limitations shown in Fig. 4 apply only to the method of operation and to the operating conditions as maintained in the Research Residence. If a larger condensing unit had been used, the limiting value of the daily median temperature, as shown in Fig. 4, would have been greater than 83.0 F and, as indicated by Fig. 5, the unit would have had sufficient capacity to maintain acceptable conditions for more than 143 days per season.

The data presented indicate the feasibility of installing refrigerating equipment of small capacity in residences, particularly in those cases in which the initial cost of installation is a more important factor than the maintenance of ideal indoor conditions in the most severe weather. The data furthermore show the limitations resulting from the use of such a small condensing unit when operated under the conditions maintained in the Research Residence.

Heat Absorbed by the Structure

It was observed in connection with Fig. 3 that during the period of continuous plant operation, when the actual heat absorbed by the cooling coil was only 65 per cent of the maximum calculated load on the Residence, the indoor dry-bulb temperature rose from 78.1 to 79.5 F, or a total rise of 1.4 F. During the season of 1936 a similar rise in indoor temperature was also observed. For example, on July 7, 1936[7] when the outdoor maximum temperature was 104.0 F, the calculated cooling load reached a maximum value of 37,000 Btu per hour, the actual heat absorbed by the cooling coil was 24,000 Btu per hour, and the indoor air temperature rose from 78.5 to 81.5 F, or a total rise of 3.0 F. In both examples, the cooling plant in use did not absorb heat at the rate indicated by the maximum calculated value of the cooling load. In view of the high rate at which the calculated cooling load increased as compared with the actual heat absorption, the magnitude of the rise in the indoor air temperature that was actually obtained appeared to be extremely small. The fact that this rise in the indoor air temperature was not greater has been attributed to heat absorbed by the building structure and furniture and not in turn given up to the indoor air.

The approximate amount of heat that would be absorbed by the Residence structure if the indoor air temperature was allowed to increase 1.0 F and equilibrium was assumed to be established under these new conditions was obtained as shown in Table 4 and Fig. 6. The weights of the different materials (columns 6 and 7) comprising the structure were calculated from the space occupied by each material, as determined by actual measurement, (columns 3 and 4) and the density of the material (column 5). The temperature rise (column 9) for those materials which were subjected to a 1.0 F rise in indoor air temperature on both sides of the material, such as a partition wall, was assumed to be also 1.0 F.

Owing to the existence of a temperature gradient, the temperature rise in those materials which were exposed to a 1.0 F rise in indoor air on one side and to a constant temperature on the other side, as in the case of an exposed wall, would be less than 1.0 F. The magnitudes of these temperature rises, based on the assumption that the indoor air temperature was allowed to increase 1.0 F and that equilibrium was established under the new conditions, were obtained by calculating the

[7]Loc. cit. Note 5.

Table 4—Heat Absorbed by the Research Residence

Item No.	Item	Volume, Cu Ft		Density,[a] Lb per Cu Ft	Weight, Pounds		Spec. Heat[b] Btu per Lb per Deg	Temp. Rise in Material,[c] Deg F	Btu Absorbed per Deg F Rise in Indoor Air Temp.	
		1st St.	2nd St.		1st St.	2nd St.			1st Story	2nd Story
1	2	3	4	5	6	7	8	9	10	11
a	Plaster, partition wall	75.3	62.1	103.8	7820	6450	0.24	1.00	1878	1548
b	Plaster, exposed wall	37.9	61.0	103.8	3940	6340	0.24	0.80	756	1217
c	Plaster, ceiling	52.3	55.7	103.8	5430	5780	0.24	1.00 & 0.73	1303	1012
d	Glass, interior doors	0.3	.....	164.0	50	.....	0.20	1.00	10	.....
e	Glass, exposed	0.8	0.8	164.0	130	130	0.20	0.25	7	7
f	Studdings, partition wall	30.7	31.3	38.0	1170	1190	0.65	1.00	761	773
g	Studdings, exposed wall	29.9	41.8	38.0	1140	1590	0.65	0.64	474	661
h	Joists, ceiling	68.5	73.0	38.0	2600	2770	0.65	1.00 & 0.51	1690	918
i	Flooring	97.2	99.6	38.0	3690	3780	0.65	0.50 & 1.00	1200	2457
j	Wood, doors	20.4	15.2	28.0	570	430	0.65	1.00	370	280
k	Wood, door frames	51.8	45.9	57.0	2950	2620	0.65	1.00	1918	1702
l	Wood, window frames	36.0	35.5	38.0	1370	1350	0.65	1.00	890	878
m	Wood, baseboard	8.3	11.5	57.0	470	660	0.65	1.00	306	429
n	Wood, top moulding	5.9	1.2	57.0	340	70	0.65	1.00	221	46
o	Wood, mantel	2.0	.....	57.0	110	.....	0.65	1.00	72	.....
p	Wood, stairs	11.2	.....	38.0	430	.....	0.65	1.00	280	.....
q	Tile in bathroom	.....	4.9	115.0	.....	560	0.21	1.00	.....	118
r	Plasterboard wall	.....	4.3	68.0	.....	290	0.40	1.00	.....	116
s	Panelling	1.9	.....	38.0	70	.....	0.65	1.00	46	.....
t	Total	.....	.....	.....	.....	.....	.....	.....	12,182	12,162

[a]Values in column 5 for density obtained from Kent's *Mechanical Engineer's Handbook*, 10th edition, pp. 183-185.
[b]Values in column 8 for specific heats obtained from Marks' *Mechanical Engineer's Handbook*.
[c]Values in column 9 for temperature rise in material based on rise of 1.0 F in the indoor air temperature maintained until equilibrium conditions are attained.

temperature gradient through the wall, making use of the general equations of heat flow and the accepted values of the conductivities of the material. In the case of an exposed wall, calculations for the temperature gradient, and hence the surface temperatures, were based first on an indoor air temperature of 80 F and an outdoor air temperature of 95 F. The average of the two surface temperatures of the lath and plaster was then considered as the temperature of the slab comprised of the lath and plaster, and the average of the surface temperature of the sheathing and lap siding was considered as the temperature of the slab composed of these materials. Similar calculations were then made for an indoor air temperature of 81 F and an outdoor air temperature of 95 F. The difference in the temperatures of each slab of material obtained by these two calculations was considered as the temperature rise for that material. A graphical representation of the temperatures established in an exposed wall, for values of the indoor air temperature of 80 F and 81 F, is shown in Fig. 6. It may be noted that for an increase in the indoor air temperature of 1.0 F, the increases in temperature for the lath and plaster and for the studs were 0.80 F and 0.64 F respectively. The increases in temperature for the sheathing and lap siding were negligibly small. Similar calculated values for other materials are shown in column 9 of Table 4.

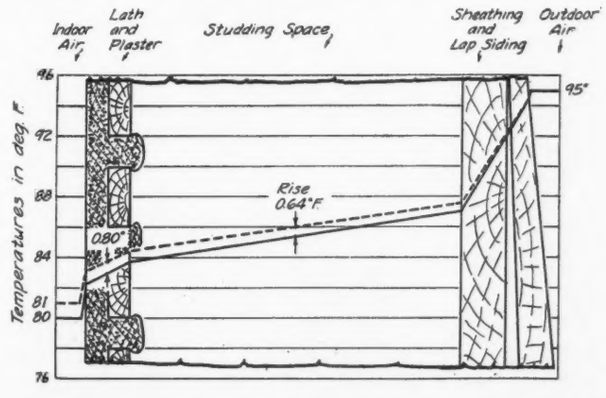


Fig. 6—Temperatures of materials comprising wall section. (Calculated values based on conditions of thermal equilibrium)

The total amounts shown in columns 10 and 11 in Table 4 indicate that the heat absorbed or given up by the Research Residence was 12,182 Btu on the first story and 12,162 Btu on the second story, or a total amount of 24,344 Btu for each one degree change in indoor air temperature. These values are for the building structure alone and do not include an allowance for the heat that could be absorbed by the furniture, floor coverings, light fixtures, books, and equipment. Therefore, an actual change of 1.0 F in the indoor air temperature is representative of a very large heat exchange. If the indoor air temperature were reduced 1.0 F a large amount of heat would be given up to the air by the structure and would represent a large additional load on the plant. Conversely, if the indoor air temperature rose 1.0 F the heat absorbed by the walls would tend to relieve the plant. For example, if the indoor air temperature changes 1.5 F during a four hour period, the rate at which heat is being absorbed or given up by the structure will be greater than 9,000 Btu per hour; which is equivalent to ¾ ton of refrigerating capacity during the four hour period.

These results emphasize the necessity, particularly where the plant capacity is limited, of starting the cooling plant each day before the indoor temperature has risen above that required for comfort conditions. If the indoor temperature is allowed to rise above 80 F, a comparatively high capacity will be required, even on a mild day, in order to effect a rapid decrease in the air temperatures, particularly at a time when the load on the cooling plant is increasing. Although these results apply to a larger extent to residence conditions, where the occupancy load is small, the effect of heat exchange between the air and the structure should also receive consideration in the case of other types of structures and under other operating conditions, particularly in installations in which a rapid reduction in the indoor air temperature is desired.

[Part 2 will follow]

Attic Fan Installation Practices

This article (Part I of two) is a recapitulation of 1938 practices covering installation of attic fans to eliminate noise, vibration, whistle and to insure easy air flow to the fan and out of the attic. The information and illustrations have been taken from manufacturers' literature, from correspondence and from actual problem jobs. To manufacturers and contractors who have contributed material, we express our appreciation.

THE theory of attic ventilation (more correctly designated as night air cooling) has been explained in such detail and so often that the fundamental principles are well understood.

Not nearly as much explanation, however, has been given installation practices which, in the final analysis, determine whether the owner is satisfied with his system. For example, a fan may move great volumes of air and reduce house temperatures quickly, thus providing night-time comfort—but, if the owner cannot sleep because his bed jiggles from fan vibration, or the air noise sounds like a wind storm in a fireplace, the owner will not be satisfied and installation shortcomings have defeated the primary purpose—restful sleep.

The installation items which add to or detract from operating satisfaction might be listed as follows:

1. The grille through which air enters the attic.
2. The fan housing.
3. Insulation to eliminate vibration.
4. Insulation to eliminate noise.
5. Fire protection.
6. Exhaust openings.
7. Provision for ventilating attic or rooms alternately.

The data to be presented in this recapitulation of current practice have been gathered from letters from contractors, manufacturers' installation manuals, sketches made on actual jobs, and suggestions from contractors who have had trouble.

It will be assumed that the contractor is familiar with methods for determining whether one centrally located grille to the attic or several individual room grilles are best; how the fan size is selected; how the grille size is determined; whether to place the fan centrally in the attic, or mounted in an attic wall; how much air must be moved; and so forth.

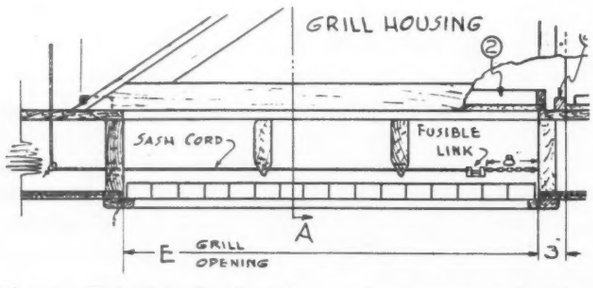


Fig. 1. This "air flow" grille opening suggested by the Robbins & Myers Co. permits of leaving the joists uncut.

The Exhaust Grille

Whether one central grille in a hall or several grilles in separate rooms are decided upon, the contractor must size the grille to keep air noise and air velocity below the noise level. And, secondly, he must finish the grille neatly so that the finished appearance is not a source of argument.

The ceiling grille opening, if possible, should be cut through so that the opening occupies full joist spaces. In other words, the determining dimension should be the side between joists. If a large grille is to be used, the fixed dimension should be one, two, three or more full joist spaces. This practice leaves a firm nailing place for cut ends of lath and saves some framing.

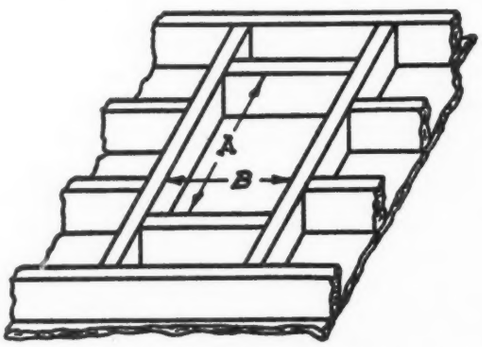


Fig. 2. This method of framing grille openings to insure a substantial opening is suggested by Viking Air Conditioning Corp.

The other dimension of the opening calls for framing and it is in the framing that contractors too often build flimsy openings. If the grille is in a hall where partitions support attic joists by a short span, the joists can be cut without much fear of weakening the attic floor. On the other hand, if the grille is midway of a long joist span, the framing must be handled carefully and understandingly.

One good recommendation for openings where

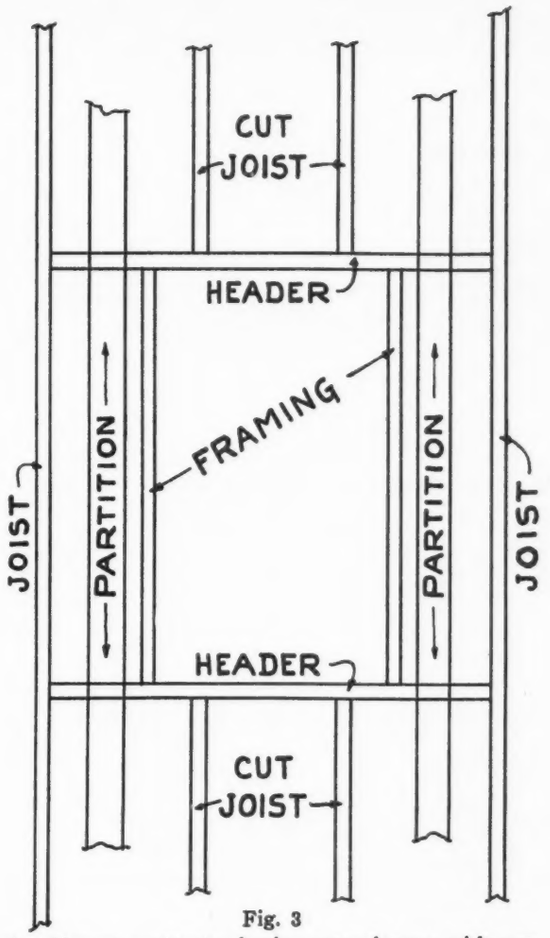


Fig. 3
A mid-west contractor having many houses with narrow second floor halls, has worked out this substantial framing for the grille.

the joists are critical is made by the Robbins and Myers Company. This manufacturer suggests that if the fan can be taken into the attic through a window or opening so that the grille opening is not also used to get the fan into the attic—the joists should not be cut completely away. The bottom third can be cut off and the remaining upper two-thirds left in place can be streamlined as in Fig. 1. In this case the grille face is put in place from below.

Where it is necessary to cut away joists, Viking Air Conditioning Corp. suggests a procedure which will prevent trouble. The opening should be marked off on the plaster ceiling. A nail driven through the four corners marks the opening in the lath of the attic floor. Before any cutting of lath and plaster is started the attic floor joists should be framed as shown in Fig. 2. Using this framing method, the cut joists are supported by headers nailed to full and uncut joists and both dimensions are variable as shown. The lath and plaster should be tacked into the framing and then cut from below. Cutting from below enables the mechanic to support the plaster and prevent cracking.

Quite frequently houses having narrow halls and attic floor joists running with the length of the hall are encountered. (See Fig. 3). A type of framing suggested by a midwest contractor who

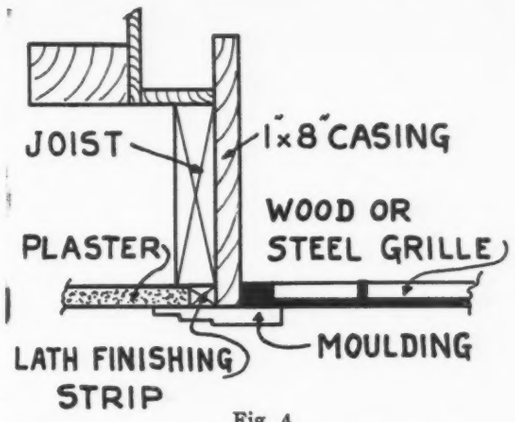


Fig. 4
This method of neatly finishing off the grille opening is taken from American Blower Co. installation manual.

has many houses of this type in his city is shown in Fig. 3. The advantage of this form of framing is that the headers carry the weight of the floor on the partition rather than on the floor joists. Even though the hall may be somewhat wider than the opening, the extra support of this method is suggested.

Framing the opening to obtain maximum support is only half the job. The second requirement is that the opening be finished off neatly. Practically all contractors and manufacturers recommend the use of moulding or flat lumber as shown. In most cases this moulding also supports the grille face. Fig. 1 shows one type of construction where a plain back band is used to finish off the raw

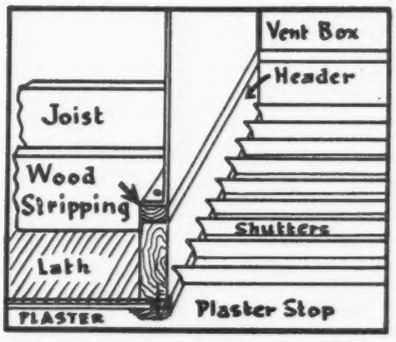


Fig. 5
Shutters which close when the fan is idle and open from fan suction are popular. Air Controls, Inc. and Reed Unit-Fans, Inc. suggest this type of installation.

plaster edge and also support the wood grille. Fig. 4 shows American Blower Company suggestion for finishing off the opening using a narrow moulding.

Air Controls, Inc., and Reed Unit-Fans, Inc., suggest automatic louvres in place of a grille. The purpose of this louvre is to shut the opening in the winter time, or when the fan is not running or in case of fire (a fusible link is used). The suggested method for framing in this louvre assembly is shown in Fig. 5 (Air Controls); the Reed louvre is placed above the attic floor and within the fan

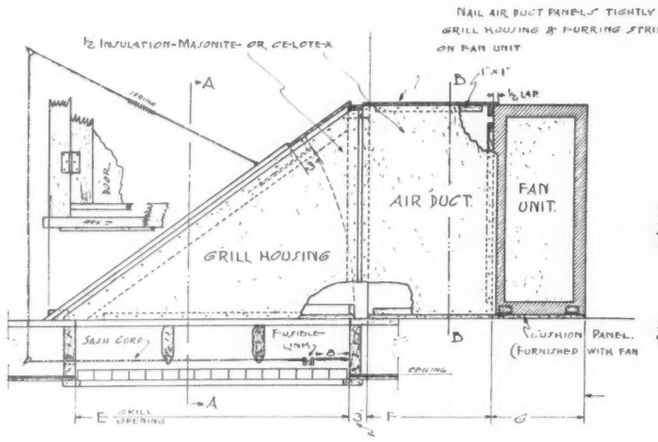


Fig. 6

This fan housing suggested by Robbins & Myers Co. is built of insulating board. The sloping top minimizes material and forms a door to ventilate the attic. The fan away from the opening reduces noise.

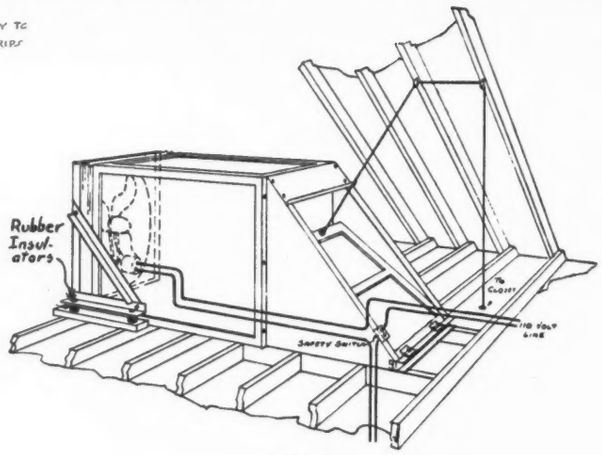


Fig. 7

Viking Air Conditioning Corp. suggests this housing with a door to ventilate the attic and a substantial fan box mounted on rubber.

housing so a grille is required and grille framing is standard.

Attic Access

Two contractors call attention to a situation which can result in expensive servicing. These contractors cite the case of the installer who used a hall trap as a part of the grille opening and after the stallation was complete there was no way for the owner to get to his fan except by way of an attic window and an extension ladder. Moral—leave some entrance through which the unit can be serviced.

Which brings us to the types and erection of housings for the fan. It is assumed here that the contractor is interested in the type of system where the fan is located centrally in the attic; the air is exhausted through windows or openings in the attic wall or eaves; the fan is in a closed system to one or more registers; and, finally, that the housing will be so constructed that either the attic, alone, or the rooms below, alone, or both areas, partially, can be exhausted.

When attic fans were first introduced manufacturers furnished little more than the fan, motor, pulley (if belted) and the framework which held the fan and motor in position. Improvements have been startling; perhaps as startling as any the practice of some manufacturers (Air Controls, Inc.; Reed Unit-Fan, Inc.; Viking Air Conditioning Corp.; Peerless Electric Co.; Lau Blower Co.; Belanger Fan & Blower Corp.; General Regulator Corp.; Robbins & Myers Co.), to furnish complete housings or fan housings to which duct sections are added to connect the grille, or to ship the fan in a crate which becomes part of the housing.

Purpose of a Fan Housing

In general, all these types of housings perform one important function. That is to connect the fan with the exhaust grille. Where this duct between fan and grille is not used, attic air and even outside air passes through the fan thus reducing the air volume from the rooms below. When attic ventilation was first adopted, most installations had the fan directly over the grille or at the grille edge, but contractors found that much quieter installations were made when the fan was moved a few feet away from the edge of the opening. These contractors also found that if the housing between grille and fan was made of some material such as insulating board the turn in the air path from upward through the grille to horizontally through the housing and then through the fan, coupled with the sound absorbing qualities of the insulating material, dampened most noise.

From this experience we find a number of interesting suggestions for building air tight, sound dampening, housings. We reproduce some of the typical housings of each general type. In Fig. 6 the suggested housing of the Robbins & Myers Company is shown. This housing seemingly has several good features. It is economical of material; easy to build (the company furnishes complete blue prints of dimensions for pieces). The housing

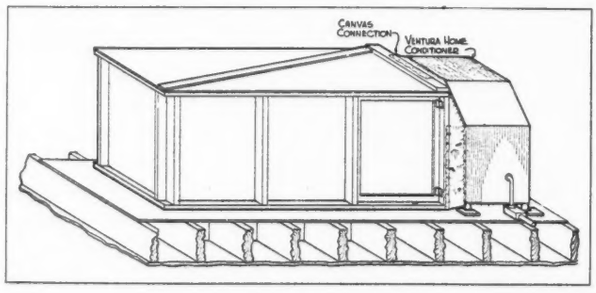


Fig. 8

American Blower Corp. recommends this coffin-shaped housing for low attics. The fan is several feet away from the opening, a canvas collar kills fan vibration and the housing is easy to assemble.

places the fan some distance away from the grille. The connection between the housing built and the fan box (furnished with the fan) is easily made with canvas. The sloping top is a door which closes off the attic when shut and ventilates the attic when lowered by means of a cord working on pul-

(*Continued on page* 64)

Precalculated Engineering

In this issue the author explains why the heat loss from infiltration is cut in half or reduced one-third when adding this loss to determine the furnace capacity required; also the heat loss caused by undampered fireplaces; the loss to be added because of makeup air for garages, kitchens, baths; and how to figure the capacity of a furnace converted from gravity to forced air.

By G. A. Voorhees

Consulting Engineer, Indianapolis

BY any of the generally accepted methods of figuring heat losses, infiltration loss is calculated for every room—yet infiltration cannot take place in every room in a given house at any one time because wind which causes infiltration, *never blows from all directions at once.*

Consequently, the sum of the heat losses of all the rooms of a house, is greater than the total heat loss of the house.

To see just how this works out in a typical case, consider the plan of the house shown in Fig. 1 with its heat loss data sheet. Each window or group of windows and each outside door opening, has its corresponding number of "equivalent" windows indicated on the plan.

The greatest number of such equivalent window openings in any one side is 10; the greatest number in any two adjoining sides is 16 and the total number of such openings in the entire house is 26.

To see the extent to which "excess infiltration" may mislead us in determining furnace capacity required, even in a relatively small house like this, we'll consider two ways of looking at infiltration loss.

First, we'll look at it from the ultra-conservative viewpoint of those extremely cautious designers who, as pointed out in the March issue, would assume that the air leakage taking place when the wind is blowing from the direction indicated by the arrow B, is equal to that occurring when wind is from direction A *plus* that when the wind is from C.

With 10 equivalent windows exposed to full infiltration when wind is from A plus 6 when wind is from C, means that under this rather extreme method of estimating maximum leakage, full infiltration would be assumed to take place through 16 equivalent windows when the wind is blowing from direction B. This would leave, under the worst possible condition of infiltration, 26—16=10 windows through which no inward leakage could occur.

As explained in the January installment of this series, the precalculated heat loss tables are based on the assumption that the leakage loss of heat for each non-weatherstripped window is 1,050 Btu. per hour so that, even from the point of view of the most conservative designer, we are justified in deducting from the sum of the heat losses of all the rooms of this house as taken from the precalculated tables, $10 \times 1050 =$ 12,500 Btu. per hour.

Second, let's adapt to the problem, the rule for estimating infiltration heat loss of a building as given in the 1938 issue of the A.S.H.V.E. GUIDE. Instead of measuring the air leakage in running feet of crack as is done in the GUIDE and in the Mechanical Heating Code of the National Warm Air Heating and Air Conditioning Association, we can just as well consider it in terms of equivalent windows because the infiltration for each such standard window (January issue) is based directly on the crackage method. Then we may

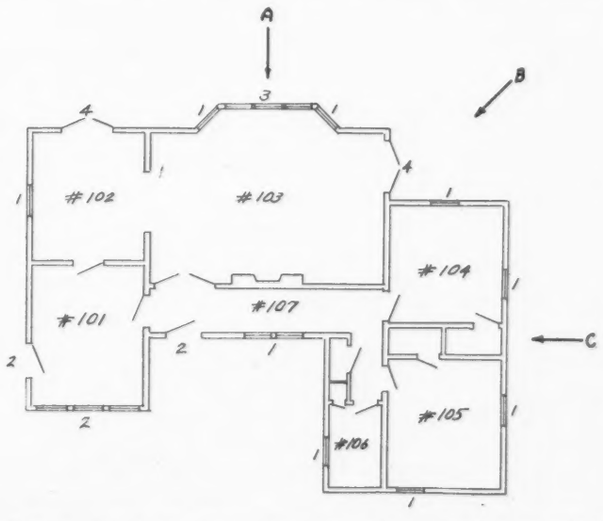


Fig. 1—Floor plan of a house showing direction of wind blowing directly on different exposures and a quartering wind.

—TABLE 13—

Total Equivalent Windows in Bldg.	Deduction of ⅓ of Total of Infiltration Losses of Rooms		Deduction of ½ of Total of Infiltration Losses of Rooms	
	Non-Weather Stripped Windows	Weather Stripped Windows	Non-Weather Stripped Windows	Weather Stripped Windows
10	3.5	2.5	5.3	3.8
11	3.9	2.8	5.8	4.1
12	4.2	3.0	6.3	4.5
13	4.6	3.3	6.8	4.9
14	4.9	3.5	7.4	5.3
15	5.3	3.8	7.9	5.6
16	5.6	4.0	8.4	6.0
17	6.0	4.3	8.9	6.4
18	6.3	4.5	9.5	6.8
19	6.7	4.8	10.0	7.1
20	7.0	5.0	10.5	7.5
21	7.4	5.3	11.0	7.9
22	7.7	5.5	11.6	8.3
23	8.1	5.8	12.1	8.6
24	8.4	6.0	12.6	9.0
25	8.8	6.3	13.1	9.4
26	9.1	6.5	13.7	9.8
27	9.5	6.8	14.2	10.1
28	9.8	7.0	14.7	10.5
29	10.2	7.3	15.2	10.9
30	10.5	7.5	15.8	11.3
31	10.9	7.8	16.3	11.6
32	11.2	8.0	16.8	12.0
33	11.6	8.3	17.3	12.4
34	11.9	8.5	17.9	12.8
35	12.3	8.8	18.4	13.1
36	12.6	9.0	18.9	13.5
37	13.0	9.3	19.4	13.9
38	13.3	9.5	20.0	14.3
39	13.7	9.8	20.5	14.6
40	14.0	10.0	21.0	15.0
41	14.4	10.3	21.5	15.4
42	14.7	10.5	22.1	15.8
43	15.1	10.8	22.6	16.1
44	15.4	11.0	23.1	16.5
45	15.8	11.3	23.6	16.9
46	16.1	11.5	24.2	17.3
47	16.5	11.8	24.7	17.6
48	16.8	12.0	25.2	18.0
49	17.2	12.3	25.7	18.4
50	17.5	12.5	26.3	18.8
52	18.2	13.0	27.3	19.5
54	18.9	13.5	28.4	20.3
56	19.6	14.0	29.4	21.0
58	20.3	14.5	30.5	21.8
60	21.0	15.0	31.5	22.5

—TABLE 14—

Heat in thousands of Btu per hour, required to warm outside air introduced for ventilation.

	Inside-outside temperature difference, degrees, F.						
	100	90	80	70	60	50	40
	Outside temperature corresponding to 70-deg. room temp.						
cfm	—30	—20	—10	0	+10	+20	+30
20	0.2	0.2	0.2	0.2	0.1	0.1	0.1
40	0.4	0.4	0.3	0.3	0.3	0.2	0.2
60	0.6	0.6	0.5	0.5	0.4	0.3	0.3
80	0.9	0.8	0.7	0.6	0.5	0.4	0.3
100	1.1	1.0	0.9	0.8	0.6	0.5	0.4
120	1.3	1.2	1.0	0.9	0.8	0.6	0.5
140	1.5	1.4	1.2	1.1	0.9	0.8	0.6
160	1.7	1.6	1.4	1.2	1.0	0.9	0.7
180	1.9	1.8	1.6	1.4	1.2	1.0	0.8
200	2.2	1.9	1.7	1.5	1.3	1.1	0.9
220	2.4	2.1	1.9	1.7	1.4	1.2	1.0
240	2.6	2.3	2.1	1.8	1.6	1.3	1.0
260	2.8	2.5	2.2	2.0	1.7	1.4	1.1
280	3.0	2.7	2.4	2.1	1.8	1.5	1.2
300	3.2	2.9	2.6	2.3	1.9	1.6	1.3
400	4.3	3.9	3.5	3.0	2.6	2.2	1.7
500	5.4	4.9	4.3	3.8	3.2	2.7	2.2
600	6.5	5.8	5.2	4.5	3.9	3.2	2.6
700	7.6	6.8	6.0	5.3	4.5	3.8	3.0
800	8.6	7.8	6.9	6.0	5.2	4.3	3.5
900	9.7	8.7	7.8	6.8	5.8	4.9	3.9
1000	10.8	9.7	8.6	7.6	6.5	5.4	4.3

Room #101	Dimensions 10X12
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 28	Heat loss 5.3

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Plain	2½X3	3	2	3.6
Outside doors	Plain	1	2	3.6
Cold ceiling	No floor	Dimensions 10X12		2.6
Cold floor	—			
Heat loss for 70-degree temperature difference				15.1
Corresponding heat loss for Temp. Diff. of degrees				

Room #102	Dimensions 10X11
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 21	Heat loss 4.0

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl.	2½X5	1	1	1.8
Outside doors	Pl	2	4	7.2
Cold ceiling	No floor	Dimensions 10X11		2.4
Cold floor				
Heat loss for 70-degree temperature difference				15.4
Corresponding heat loss for Temp. Diff. of degrees				

Room #103	Dimensions 13X20
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 27	Heat loss 5.1

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl	2½X5	5	5	8.9
Outside doors	Pl	2	4	7.2
Cold ceiling	No floor	Dimensions 13X20		5.7
Cold floor	—			
Heat loss for 70-degree temperature difference				26.9
Corresponding heat loss for Temp. Diff. of degrees				

Room #104	Dimensions 10X10
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 20	Heat loss 3.8

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl	2½X5	2	2	3.6
Outside doors	—			
Cold ceiling	No fl.	Dimensions 10X10		2.2
Cold floor	—			
Heat loss for 70-degree temperature difference				9.6
Corresponding heat loss for Temp. Diff. of degrees				

Room #105	Dimensions 10X11
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 21	Heat loss 4.0

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl	2½X5	2	2	3.6
Outside doors	—			
Cold ceiling	No fl.	Dimensions 10X11		2.4
Cold floor	—			
Heat loss for 70-degree temperature difference				10.0
Corresponding heat loss for Temp. Diff. of degrees				

Room #106	Dimensions 5X8
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 13	Heat loss 2.5

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl	2½X2½	1	0.6	1.8
Outside doors	—			
Cold ceiling	No fl.	Dimensions 5X8		0.9
Cold floor	—			
Heat loss for 70-degree temperature difference				5.2
Corresponding heat loss for Temp. Diff. of 80	15% = degrees			0.8 6.0

Room #107	Dimensions 4X20
Construction of exposed wall	#14
Table No. 4	Ceiling height 9
Running feet exposed wall 15	Heat loss 2.8

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Pl	2½X2½	2	1	1.8
Outside doors	Pl	1	2	3.6
Cold ceiling	No fl.	Dimensions 4X20		1.8
Cold floor	—			
Heat loss for 70-degree temperature difference				10.0
Corresponding heat loss for Temp. Diff. of degrees				

Room	Dimensions
Construction of exposed wall	
Table No.	Ceiling height
Running feet exposed wall	Heat loss

WINDOWS Type	Dimensions	No.	Equiv. No. of standard windows	
Outside doors	Type			
Cold ceiling		Dimensions		
Cold floor				
Heat loss for 70-degree temperature difference				
Corresponding heat loss for Temp. Diff. of degrees				

say that (considering the house as a whole) the maximum loss of heat due to infiltration at any one time, could not be greater than the leakage loss through one-half of the total number of equivalent windows. For the remaining one-half of the total number of equivalent windows there would be (according to the A.S.H.V.E. method) *no* infiltration.

This means that under the worst conditions in this house having 26 equivalent windows, there will be 13 through which no infiltration is taking place—yet in our room-by-room estimate of heat losses we have assumed full leakage for every window. At 1050 Btu. leakage loss per window, we are therefore justified in deducting from the sum of the heat losses of all the rooms, $13 \times 1050 = 13{,}650$ Btu. per hour.

The accompanying Table 13 is offered for convenience in determining what deduction to make for excess infiltration and thus correct or adjust the sum of the heat losses of the various rooms to arrive at a more accurate estimate of the heat requirement of the house as a whole and consequently, of the furnace capacity needed.

The rules for using Table 13 are:

1. Add together the heat losses of all the rooms. (See illustrative tabulation below).

2. Determine the number of equivalent windows in the entire building and their type, whether plain sash or weatherstripped.

3. In the left hand column of Table 13, locate the total number of equivalent windows in the building, and in the same horizontal line to the right, find in the appropriate column, the excess infiltration loss in thousands of Btu. per hour, to be deducted from the sum of the heat losses of the rooms.

First, tabulating the heat losses and equivalent windows of the rooms of the house shown in Fig. 1, we have:

Room No.	Heat loss in thousands of Btu per hour	Number of equivalent windows
101	15.1	4
102	15.4	5
103	26.9	9
104	9.6	2
105	10.0	2
106	6.0	1
107	10.0	3
Total	93.0	26

To find the deduction to be made from the total of 93.0, locate the number of equivalent windows, 26, in the left hand column of Table 13. Since the data sheet shows the windows in this house to be the plain (non-weatherstripped) type, we find in the same horizontal line with 26, that if we want to be extra conservative,

the value to subtract from the total of the room losses is 9.1 which is deducting one-third of the total infiltration estimate. If we want to be more liberal and follow the more common practice, we subtract 13.7 which is one-half of the room-by-room total of infiltration.

Thus, for the most conservative allowance, we have 93.0 — 9.1 = 83.9 or 83,900 Btu. per hour which is the quantity of heat that the furnace must have the capacity to deliver at the registers.

For the more usual allowance, we get 93.0 — 13.7 = 79.3 or 79,300 Btu. per hour.

Notice that according to the more common practice of deducting one-half of the total infiltration, it means that, for this particular house, the actual heat loss of the house as a whole (and consequently the capacity required of the furnace) is

$$\frac{93.0 - 79.3}{93.0} \times 100\% = 14.7\%$$

less than the sum of the heat losses of the rooms. This percentage will not be the same for all jobs by any means, but usually it is large enough to justify applying a correction in arriving at the proper furnace size.

Some designers will prefer to make no deduction whatever for excess infiltration and will want to keep that excess included in their final figures as an added assurance that the furnace specified, will be of ample size. There's no objection to this practice where the correctness of the heat loss estimates may be in doubt as, for example, a house of very unusual design or construction or in cases where the engineer who figures the requirements and lays out the job doesn't see the house itself or is not supplied with *complete* and accurate plans and structural data.

Accounting For Make-up Air

The foregoing discussion of the quantity of heat which the furnace must supply, refers to that needed to offset the normal heat loss of the building but does not take into account the introduction of *make-up air* to replace room air removed from kitchens, bath rooms, attached garages or any other heated spaces from which room air is vented instead of being recirculated.

Unless such make-up air is introduced directly into the return air side of the system through a fresh air intake duct, it will enter by infiltration. It doesn't matter *how* the make-up air enters—the heat loss exists *because vented air must be replaced with outdoor air.* And to offset the consequent loss of heat, the furnace must supply heat to raise that incoming air from outdoor temperature to room air temperature.

In a house of average size, if such venting is limited to one small bath room, the resulting increase in load on the furnace may be ignored. Neither is it very serious if a kitchen ventilating fan of small capacity is turned on occasionally and run for short intervals to remove cooking odors.

But in larger houses where two or three bath rooms, a kitchen and an attached garage are being continuously vented through vent flues, two things should be done:

1. The necessary make-up air should be brought in through a fresh air duct and warmed by the furnace before it is delivered to the rooms, instead of being allowed to enter the rooms directly by abnormally increased infiltration through window and outside door cracks.

2. The quantity of heat required to raise the temperature of the make-up air from outside to inside temperature, should be added to the previously calculated heat requirement of the house, to properly determine the furnace capacity needed.

How Make-up Load is Figured

Among designers who make a practice of taking this added load into consideration in determining required furnace capacity, some calculate the Btu. requirement precisely; others content themselves with a rough estimate based on experience. In most residence work, a *reasonably* close estimate will serve as well as a precise calculation and it is believed that such an estimate will be accurate enough for practical purposes if it is based on the accompanying Table 14 as indicated by the following example:

Suppose that in a given house, a kitchen, two bath rooms and an attached garage are vented and that, in the design of the system, it has been found that the respective volumes of warm air required by the rooms are:

Kitchen	145 cfm
2 baths, 55 cfm each	110 cfm
Garage	200 cfm
Total	455 cfm

Referring to Table 14, the left hand column does not show 455, but a close approximation would be 400 cfm. + 60 cfm. If the plant is designed on the basis of an outside temperature 10 degrees below zero, we locate 400 in the cfm. column and in the same horizontal line to the right, we find in the —10 degree column, that the quantity of heat required to warm 400 cfm. from 10 degrees below zero to 70 degrees above, is 3.5 which means 3,500 Btu. per hour. Locating 60 in the cfm. column we find by the same procedure that the corresponding heat requirement is 0.5 or 500 Btu. per hour. Hence the total quantity of heat needed to warm the make-up air is approximately 3.5 + 0.5 = 4.0 or 4,000 Btu. per hour. If the normal heat loss of the house is 102,500 Btu. per hour, then the total heat load on the furnace is 102,500 + 4,000 = 106,500 Btu. per hour.

Some who are accustomed to precise calculations may object that the method here suggested is wrong in several particulars. First, that the cfm. required by a room is measured at the register air temperature according to the New Technical Code, whereas it is treated here as being the volume at 70 degrees. Second that the room air temperature of bath rooms will usually be 80 degrees instead of 70 degrees as assumed here. Third, that the air temperature of the garage is probably about 40 or 50 degrees instead of 70. These objections are correct from the standpoint of precise calculations but, unless very unusual conditions are met, it will be found that the increase in accuracy resulting from precise calculations is hardly worth the effort.

Heat Loss of Fireplaces

The suction of a chimney flue withdraws a considerable volume of air through an open fireplace. In the newer houses where such fireplaces are equipped with dampers and where the dampers are kept closed when the fireplace is not in use, the condition is not particularly serious. But in those sections of the country where the older houses have such fireplaces in all of the principal rooms, upstairs and down, they may easily add 10 to 15 per cent or more, to the heat which the furnace must supply because they continuously withdraw air at room temperature and the make-up air brought in through a fresh air duct or allowed to seep in through window and door cracks, must be warmed from outdoor temperature to the average room temperature.

Among furnace men who have made a practice of allowing for this increased load on the heating plant, there seems to be no fixed policy governing the amount to add to the calculated load to compensate for the increased requirement. The only recommendation which the writer has to offer is based on anemometer tests made several winters ago, of the air entering undampered fireplace flues on probably a couple of dozen jobs in Kentucky where many of the older houses have such open fire places. The average volume of air being withdrawn from the building through such flues was about 200 cfm. per fireplace as shown by those tests, and according to Table 14, if zero outside temperature is assumed, this would mean that 1.5 or 1,500 Btu. per hour should be added to the normal heat load of the furnace for *each* fireplace. Those tests were all made with no fire burning in the fireplace. With a fire, the volume of air withdrawn would probably be somewhat greater because the flue would then be hot and the suction much stronger. The heat generated by the fire and radiated into the room would more than offset the quantity of heat of which the room would be robbed by the increased withdrawal of room air.

Capacity of Converted Gravity Furnaces

Many gravity type furnaces which are used for mechanical heating are rated by their manufacturers in square inches of gravity leader area only. So the dealer must determine *from the gravity ratings* what the capacities of those furnaces are, when a blower is added and the plant is installed for mechanical rather than gravity circulation.

Fortunately there is a direct relation between the capacity of a given furnace in square inches of gravity leader area, and the capacity of that same furnace in Btu. per hour delivered at the registers when mechanical circulation is used.

The Technical Code for Mechanical Heating gives the following formula for determining the capacity of a furnace with forced circulation:

$$\text{Btu. at reg.} = 0.85 \times (G \times E \times F \times C) \times [1 + 0.02\ (R - 20)\ ] \quad \ldots\ldots(1)$$

in which

0.85 = per cent (expressed as decimal) of the heat available at the furnace bonnet, which is delivered at the registers—in other words, it allows a heat loss of 15% between bonnet and registers in mechanical heating.

G = grate area of furnace **in square feet**

E = per cent (expressed decimally) of the heat content of the coal fired, which is available as useful heat in the air at the furnace bonnet. The Code recommends that this be taken as 0.65 for mechanical heating.

F = heat content of the coal in Btu per pound and it is suggested in the absence of reliable information to the contrary, that this be taken as 12,000.

C = combustion rate, pounds of coal burned per square foot of grate per hour.

R = ratio of heating surface to grate area.

Substituting 0.65 for E, 12,000 for F and 7.5 for C in Equation (1) we have:

$$\text{Btu at reg.} = 0.85 \times G \times 0.65 \times 12{,}000 \times 7.5 \times [1 + 0.02\ (R\text{-}20)]$$
$$= 49{,}725 \times G \times [1 + 0.02\ (R\text{-}20)] \quad \ldots(2)$$

Hence, if the manufacturer's published data gives the grate area and either the area of heating surface or the heating-surface-grate-area ratio, for each of his gravity furnaces, their Btu. capacities at the registers for forced air heating may be determined by substituting the given values in the foregoing equation.

But often that data is not given and only the gravity leader area is shown. If that gravity leader area has been determined according to the gravity rating formula of the National Warm Air Heating Association, it can be very easily converted into Btu. forced air rating.

To show the application of the gravity furnace rating formula, the Standard Gravity Code, 9th Edition, uses as an illustrative example, three furnaces, each of which has the same grate area but with different areas of heating surface as follows:

	Furnace No. 1 Positive Correction	Furnace No. 2 No Correction	Furnace No. 3 Negative Correction
Grate area, sq. in. =	346	346	346
Heating surface area sq. in. =	7540	6920	5665
Ratio heating surface area to grate area =	21.8 to 1	20.0 to 1	16.4 to 1
R — 20 =	1.8	0.0	—3.6
Correction per cent =	3.6	0.0	—7.2
1.75 G =	606	606	606
L = 1.75 G + correction =	628	606	562

The grate area of 346 square inches is equivalent to $346 \div 144 = 2.4$ square feet, and by substituting 2.4 for G in equation (2) we have for these same three furnaces:

$$\text{Btu at registers} = 49{,}725 \times 2.4 \times [1 + 0.02\ (R - 20)]$$
$$= 119{,}340 \times [1 + 0.02\ (R - 20)]$$

Correcting for the three different ratios of heating surface to grate area expressed by the factor $[\,1 + 0.02\ (R - 20)\,]$, we get:

	Furnace No. 1 Positive Correction	Furnace No. 2 No Correction	Furnace No. 3 Negative Correction
R	21.8	20.0	16.4
R-20	1.8	0	—3.6
0.02 (R — 20)	0.036	0	—0.072
1 + [0.02 (R — 20)]	1.036	1.0	0.928

Now that we have for each of these three furnaces the numerical value of the factor $[1 + 0.02\ (R—20)\,]$, we determine their respective forced air heating capacities in Btu. per hour at the registers by

(*Continued on page* 94)

Characteristics of Air Borne Particles [Part 2]

By John W. Kurtz

Head, Department of Engineering
Municipal University of Omaha

This article, the article in April and one article to follow, are taken from a thesis of the author—"The Relative Efficiency of Air Conditioning Filters." This article discusses types of filters and how they clean; the last article will discuss methods for securing better filtering results.

HOW does the available apparatus go about air-cleaning?

1. Passing the dirty air stream through a water spray. This causes those dust particles which come in contact with drops of water to be made wet, and heavier, and to drop out of the air stream along with the water droplets.

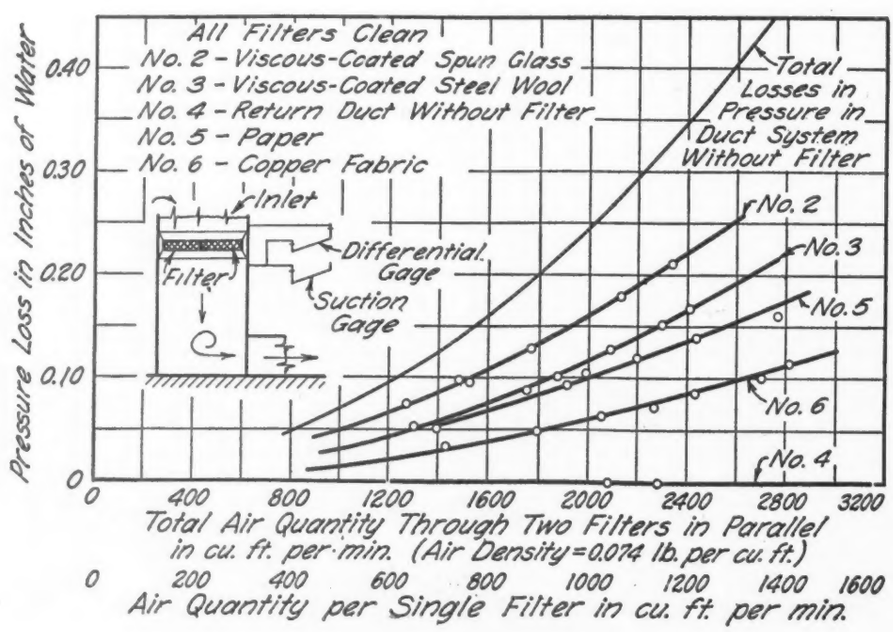
2. Causing the dirty air to change its direction abruptly with the idea of throwing the dust particles out of the stream.

3. Causing the dirty air to strike against sticky or adhesive surfaces which will catch the dust particles and hold them.

4. Passing the dirty air stream through a finely woven screen of fabric or similar material usually textile, which catches the dirt particles at the surface and refuses to let them pass through. Virtually all the dust-separating equipment now available for ventilation work uses one or more of these methods.

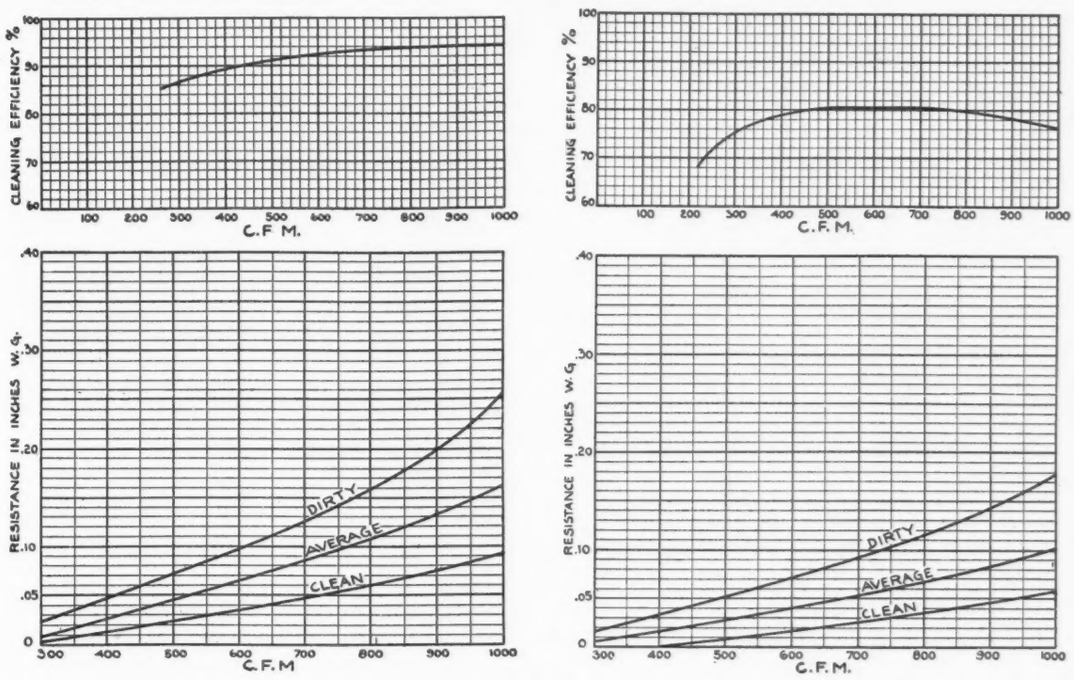
The materials used for filtering air varies. The air washer type has increased in application in spite of the fact that washers remove little soot, carbon and bacteria. In fact, installations are now being made where air washers are supplemented with air filters—the washers are used to humidify and temper the air rather than to filter the air. The air washers, besides having the advantages of adding moisture to the air stream or extracting moisture from it, also do not build up a resistance to air flow.

Fiber or fabric filters are the oldest types of filter medium, for a time they fell into disuse, but have been revived in late years and improved by adding an adhesive.


All Filters Clean
No. 2 - Viscous-Coated Spun Glass
No. 3 - Viscous-Coated Steel Wool
No. 4 - Return Duct Without Filter
No. 5 - Paper
No. 6 - Copper Fabric
Inlet
Filter
Differential Gage
Suction Gage
Total Losses in Pressure in Duct System Without Filter
No. 2
No. 3
No. 5
No. 6
No. 4
Pressure Loss in Inches of Water
0.40
0.30
0.20
0.10
0
0 400 800 1200 1600 2000 2400 2800 3200
Total Air Quantity Through Two Filters in Parallel in cu. ft. per min. (Air Density = 0.074 lb. per cu. ft.)
0 200 400 600 800 1000 1200 1400 1600
Air Quantity per Single Filter in cu. ft. per min.

Pressure losses through four types of clean air filters. Chart from "Forced Air Heating Facts from the Research Residence," by S. Konzo, February, 1936. This chart not contained in author's paper.

Performance data for two types of air filters, as published in Bulletin 117 of the American Air Filter Co. Courtesy of the American Air Filter Company.



The curves on the left are for the "Reed E-Z-Kleen" filter, which is a more closely packed filter than the "American wafer" filter, whose performance curves are shown on the right. Note that the higher resistance of the former filter is accompanied by higher cleaning efficiency. It is apparent that both cleaning efficiency and pressure resistance should be considered when selecting a filter for a given service. Charts from "Forced Air Heating Facts from the Research Residence," by S. Konzo, February, 1936. This chart not contained in author's papers.

Relation of Principles to Types

The filter material used depends on the cleaning principles, enumerated on above.

The filters using the adhesive impingement principle such as the "Dustop" (Owens-Illinois Glass Company) arrange the spun glass so it shall cause as many of the dust particles as possible to strike the adhesive-covered surfaces. The material breaks up the air stream in order to aid this process. Progressive filter densities provide relatively large spaces for the collection of dirt in the front of the filter where the bulk of the dust is taken out without undue increase in resistance, while at the back of the filter the openings are smaller to secure high efficiency in the removal of the finer dust particles.

The resistance of a well designed unit filter of the adhesive impingement type usually depends upon the velocity at which the air is handled and upon whether the unit is clean or dirty. The cleaning efficiency of the unit is usually highest after it has accumulated a certain portion of its maximum load of dirt because some dust collected acts as an efficient medium for the further seizing of solids from the air.

The Independent Air Filter Company relies upon the breaking up of the air stream and the air pocket between the filters of the "Fibre-Pak" to arrest the impurities in the air stream. This medium is a sea weed or Spanish moss. It produces an odor when it gets wet or damp. (Editor's note: "Permo Flame Proof" filters have replaced "Fibre-Pak.")

The "Throwway" steel wool type, (American Air Filter Company) and the fine, spun glass filters manufactured by the H. J. Somers, Incorporated depend upon the straining or screening action of the filtering medium to cleanse the air stream. The Somers filters may be reconditioned by air, water, or chemicals.

Filters containing felt, cloth, paper, cellulose fiber, spun metals, fabric, or any combination of these do not require an adhesive liquid, but depend upon the straining or screening action of the filtering medium. Some filters are affected by moisture, which tends to cause a rapid increase in resistance; these are treated or processed to minimize the effect of changes in humidity. Filters tested which were so processed were the "Airmat" manufactured by the American Air Filter Company, Inc., the "Staynew" manufactured by the Staynew Filter Company, and the "Perfex" manufactured by the Milwaukee Air Filter Company. All of these filters contained a cotton fibre or cellulose composition medium.

Because of the close texture of the filtering media used in most of the "dry" filters, the surface velocity ranges between ten and fifty feet per minute, depending on the nature and texture of the fabric. This necessitates a relatively large screen surface, and the filter media are usually arranged in the form of pockets, square or "V" shaped in order to bring the frontal area within customary space requirements.

Dry-type air filters are best suited for general ventilation service; other than that, for large industries. Such filters are designed for an air velocity of about 45 feet per minute. Their resistance is from 0.06 to 0.18 inch of water. Those used for large industrial work have a resistance of less

than 0.3 inch of water at velocity of 10 to 20 feet per minute.

As in the case of the viscous filter, the dry filters are not suited for service as a dust collector. If the dust concentration is too high, the filter will become clogged and the resistance will increase. Rapping devices are provided to clean dry filters in some instances.

Where the air is heavily laden with atmospheric dust, viscous-type filters are recommended; unit types for small air requirements; and automatic types for intermediate and large installations. "Airmat" (dry filters) are best suited for light or average dust concentrations of less than one grain per one thousand cubic feet of air. Viscous filters are most serviceable with granular dust, while the "airmat" offers an advantage with dust of a linty or fibrous nature, which it can handle successfully in large quantities.

The air washer, the electric precipitator, the centrifugal-effect collector, and the vorticose cleaner are dust collectors that are used in places of extremely high dust concentrations and in situations where each is warranted to gather together the dust for future use.

In general, wet methods (air washer) of dust collecting are, however, poor, due to the air film surrounding the dust particles. In order to collect a dust particle, it must be wetted. The American Air Filter Company claims that as little as fifty per cent of soot and carbon are removed by air washers.

One of the simplest devices for cleaning air consists merely of a piece of cloth through which the air is filtered for the removal of the dust particles that cannot pass through the meshes of the cloth fabric. Filters of this kind are still in use for some purposes, but not as a rule for the cleaning of air for air conditioning.

Creameries use this type of filter in manufacturing condensed milk. The air is filtered through viscous coated curtains of felt before it is used to evaporate the moisture from the atomized milk particles in a partial vacuum.

The reason that they are not used for air conditioning installations is that the air resistance is high and variable if the cloth is "fine" enough to remove the smallest particles of dust; also the cleaning of such fabrics is difficult.

These difficulties may be avoided to some extent by designing a fabric filter so that the air velocity through it will be quite low. When this requirement is to be met in the design, it means that relatively large areas of cloth must be provided. Such filters are, therefore, expensive to operate.

In the application of a viscous oil film for air cleaning, the air is ordinarily drawn through a series of deflecting surfaces, usually made of metal, and these surfaces are coated with viscous oil. When the air to be cleaned comes in contact with these deflecting surfaces, the direction of flow is abruptly changed and, as a result, the clean air readily passes through, but the dust (which is heavier than the air) has so much inertia that its direction of flow is not easily changed and it remains entrapped in the viscous oil film; for this dust-collecting service the oil film has both collecting and retaining properties.

Viscous filters have found large application in industrial work. They are usually designed for an air velocity of from 350 to 400 feet per minute. At this velocity, the air resistance varies from 0.15 to 0.30 inch of water. There are drawbacks, however, to the viscous filter. Its application is limited to light loadings of dust and to cool air. Therefore, it is used only in air purification and not as a dust collector.

Attic Fan Installation

(*Continued from page* 56)

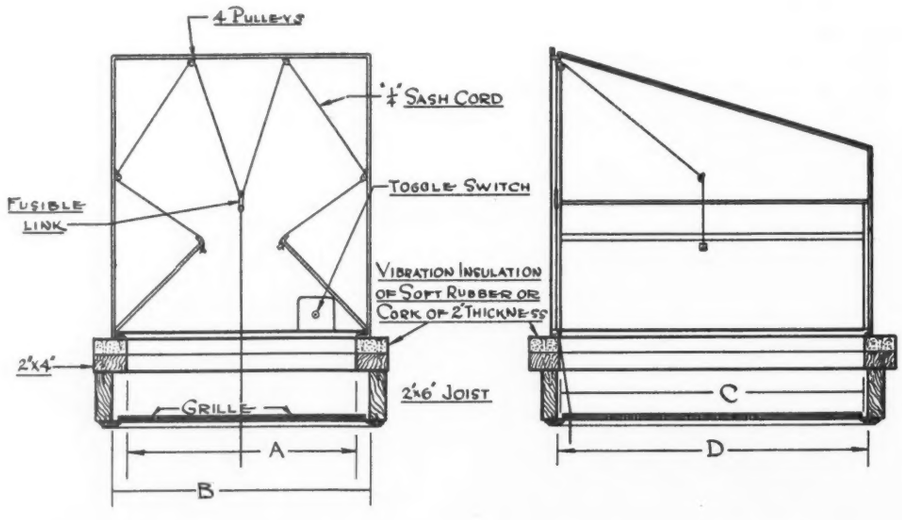


Fig. 9

Air Controls, Inc., furnishes this steel housing, shipped knocked down, and featuring the attic ventilating panels. The fusible link melts in case of fire and closes the grille.

leys to the room below. The housing is built over a full floor.

Fig. 7 shows the air duct of the Viking Air Conditioning Corp. which is quite similar, but all pieces are furnished complete in a carton. Viking recommends the sound absorbing board which consists of five layers of jute board separated to form four dead air spaces. The boards are boiled in paraffin for moisture proofing.

American Blower Corp. recommends a rectangular housing built of materials cut on the job as

(*Continued on page* 80)

Are You Providing

WHAT YOUR CUSTOMERS EXPECT

from

AN OIL BURNER MOTOR

?

QUIET STARTING... Listen to a Century Motor! It does not "grunt" or "howl" during the starting period.

QUIET OPERATION... Listen to the motor running at full speed. It is quiet under full load because accurate construction and liberal design prevent mechanical noise. Electrical design prevents humming. Good balance holds down vibration.

LONG LIFE... All materials are selected and inspected for the duty they must perform to insure long life. Thick-walled, large-area phosphor bronze bearings rigidly held in place. Century Wool Yarn System of Lubrication requires reoiling once a year. Insulation protects the motor during idle summer months in damp basements, a condition more severe than actual operation.

Specify Century Oil Burner Motors and get these necessary benefits.

Century MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine Street • • • St. Louis, Mo.

Offices and Stock Points in Principal Cities

How Do YOU Pick Out Heating Equipment and Materials?

About the only shopping done by many sheet metal, heating and air conditioning men is for gifts at holiday time. Instead of searching here, there and everywhere to find the best materials for a job, they look to Osborn for them. After all, that is a valuable part of our service to the trade.

Take heating and winter air conditioning materials and equipment for example. The adjoining list shows only a part of the many items we carry. It takes time . . . and lots of it . . . to select the leading make in each of these lines . . . time which is well spent when you serve thousands of steady customers.

Would you like to save the bother and expense of shopping for materials? The Osborn salesman, who calls regularly in your city, can help you. So can the Osborn No. 37 Stock List. Both are at your service for the asking.

- FLAT SHEETS (all metals and gauges)
- FURNACES, CAST IRON
- FURNACES, STEEL (coal, gas or oil)
- BLOWERS AND FANS
- FILTERS, AIR
- AUTOMATIC REGULATORS AND CONTROLS
- HUMIDIFIERS, AUTOMATIC
- STOKERS
- FURNACE PIPE & FITTINGS (air conditioning) (gravity)
- REGISTERS (air conditioning) (gravity)
- COLD AIR FACES
- DAMPERS, CHECK
- DAMPERS, HOT AIR
- DAMPER REGULATORS
- FURNACE COILS
- FURNACE CEMENT
- INSULATION
- ASBESTOS PAPER
- PASTE FLOUR
- ASBESTOS MILLBOARD
- FURNACE CHAIN
- FURNACE PULLEYS
- FURNACE BRUSHES
- VACUUM CLEANERS
- SHEET METAL SCREWS
- RIVETS AND BOLTS
- ALL TYPES OF HAND, BENCH AND POWER TOOLS AND MACHINERY

THE J. M. & L. A.
OSBORN Co
Manufacturers—Distributors
BUFFALO · CLEVELAND · DETROIT
Metals and Metal Products

A DEPENDABLE SOURCE OF SUPPLY FOR 79 YEARS

Pennsylvania Contractors Reorganize State Association

AFTER several years of inactivity, contractors of Western Pennsylvania met at Altoona June 23 and 24 for the purpose of reorganizing the Pennsylvania Sheet Metal & Roofing Contractors' Association.

Acting president Fred M. Braeger of Erie and Louis Luckhardt of Pittsburgh presented to the convention the new constitution and by-laws which were unanimously adopted by the convention assembled. A nominating committee consisting of R. F. Hahn, Easton; Walter Keist, Pittsburgh; J. A. Harper, Monaca; suggested the following individuals for officers.

President, A. J. Sabathne, Altoona; first vice-president, R. F. Hahn, Easton; second vice-president, S. H. Meyers, New Kensington; secretary, M. F. Liebermann, Ambridge; treasurer, H. G. Hartline, Erie.

These officers were duly elected and will serve for the coming year.

Possibilities for More Work

Edwin A. Scott, editor, Sheet Metal Worker, described the things an association can do to increase its effectiveness and promulgate the "good-neighbor" spirit. Mr. Scott pointed out some of the possibilities for new work for the sheet metal worker and roofing contractor. He also suggested that proper methods for figuring work should be emphasized so that under-pricing might be eliminated and poor bids effectively stopped.

Why Old Association Died

M. F. Liebermann, outlining why the original Pennsylvania association ceased to function, explained that the last state convention was held at Johnstown in 1931 and was a very successful meeting. Before the 1932 convention could be held at Reading, the depression took hold in earnest and it was the opinion of the board of directors that the Reading convention would not be well attended. Accordingly, the Reading 1932 convention was postponed, but then came the NRA which seemed to indicate the end of all need for associations.

As to the need for an association, Mr. Liebermann pointed out that the things an association might do can be summed up as follows: 1. To foster the business of the members of an association; 2, to reform the abuses relative to the operation of the industry; 3, to promote friendly intercourse among contractors in the industry; 4, to secure equitable treatment for all members; 5, to effect uniformity in customs and practices; 6, to bring together for the benefit of members, the best talent and experience and ability.

An association might also, declared Mr. Liebermann; maintain relationships between members and employees; prevent unjust and unreasonable discrimination against members; get relief from present excessive compensation tax rates; protect the business interest of the sheet metal and roofing industry. As a further pressing need, Mr. Liebermann emphasized that in order to accomplish a free and unbiased interchange of business relationship, exact costs of doing business must be established and made known to all members. If relief is to be secured from excessive compensation insurance rates and various tax laws now considered discriminatory, a united front and a co-operative organization must tackle the work to be done.

New Applications of Copper

H. E. Vogeli, service engineer of American Brass Company, explained some of the changes which have come about in the application of copper for architectural metal work, and pointed out some of the possibilities in new forms of copper application. For example, the application of light copper sheet for damp-proofing, waterproofing, insulating, and general weather protection.

Reduced Insurance Rates

E. F. Gleason, representative of the Pennsylvania Manufacturers' Association, declared that organization was the only thing Pennsylvania contractors needed to bring about the reform so clearly pointed out and so badly needed. Mr. Gleason said workman's compensation rates for Pennsylvania are being increased rapidly and explained how his association might be of service to contact the compensation board at Harrisburg and to secure the results desired. Mr. Gleason offered to meet with a representative committee of the sheet metal contractors in an effort to take the members of the Sheet Metal and Roofing Contractors Association of Pennsylvania into the Pennsylvania Manufacturers' Association which automatically will qualify each member for insurance in the Pennsylvania Manufacturers' Association Casualty Insurance Company with a resultant substantial decrease in premiums paid.

Pennsylvania Workmen's Laws

Harry M. Engel, claim manager, Pennsylvania Manufacturers' Association Casualty Insurance Company, speaking on workmen's compensation in Pennsylvania, explained that compensation is a comparatively new system for providing a benefit to injured workmen. The Pennsylvania law became effective in 1916. Mr. Engel said that while some employers did provide some measure of benefit for their injured workmen, the system was largely of the hit and miss variety; the purpose, therefore, of the compensation laws was to give the injured workman a fair deal. Mr. Engel said that whereas the law originally was supposed to cover the accident where a workman fell off a ladder, the provisions written into the law and by interpretation have spread out and now include disability and death resulting from causes that were never remotely considered as the responsibility of the employer. Today, accordingly, employers find that sunstroke and heatstroke have been classified as accidents, injury or death from lightning, insect bites, a worker becoming ill on the employers' premises, an epileptic who falls and breaks an arm, stray shots from a hunter's rifle injuring a quarry workman, accidents resulting from horseplay, and all such fringe accidents have become compensable.

According to Mr. Engel, the Pennsylvania legislature in 1937 rewrote the law to make it more liberal, with the result that compensation is not affected by the fact that the employee may be violating a law or rule at the time of the injury. Further, occupational diseases originally were not compensable, but today they are. In 1933 a commission studying occupational diseases found that compensation had been awarded for disabilities resulting from some 48 diseases or ailments. These included such diseases as diabetes, sciatic rheumatism, cancer, alcoholic tremens, tuberculosis, and others. These conditions lead to the feeling that Pennsylvania workmen's compensation is organized for its social aspects rather than straight injury compensation. Also, whereas the original compensation law was supposed to be calculated at 65 percent of the weekly wage, this has been construed to mean 5½ days of work per week, so many injured workmen are receiving more accident compensation than they drew in recent weeks of work. This provision has been further liberalized by setting a minimum of $12 per week as compensation insurance. Figures for compensation insurance rates in Pennsylvania are—in 1923, $3 per hundred; in 1928, $4.50; 1933, $5.25; 1936, $7.25; and for 1938, $10.00 for $100 of payroll. Under the 1938 law for a permanent total disability, the weekly rate would be $18 per week for 500 weeks and thereafter $30.00 per month for life. This might result in a total payment of more than $20,000.

Sheet Metal 50 Years Ago and Now

W. C. Markle, Pittsburgh, speaking on inroads made by other industries, declared that this situation is one of the most difficult problems to confront our industry. The small tin shop of 50 years ago, declared Mr. Markle, did a considerable volume of work in tin roofing, gutter and downspout (these gutters and downspouts made up in the shop) made tinware, made up numerous articles for the shop during bad weather or during the winter, made up for stock and to be sold innumerable items such as tin cups, dishes, pans, etc., might even be called to solder tops on fruit cans, and all these items have been replaced by manufactured products.

Sheet metal cornices were popular fifty years ago, for a number of years no store, factory or residence was considered complete without a sheet metal cornice or sheet metal ornamentation. Today there is practically none of this ornamentation. Twenty-five years ago hollow metal windows were developed and for many years large numbers of large shops manufactured hollow metal windows in carload orders. Today these windows are used only in a few large cities. Twenty-five years ago hollow metal doors and trim were developed, but because of the limited demand and expensive machinery required, very few shops are engaged in this particular line.

As an example of what can be done along the lines of new work, Mr. Markle cited Roger Bab-

(*Continued on page* 96)

OFFICERS

Pres.—A. J. Sabathne, Altoona.
1st V.-P.—R. S. Hahn, Easton.
2nd V.-P.—S. H. Meyers, New Kensington.
Sec'y—M. F. Liebermann, Ambridge.
Treas.—H. G. Hartline, Erie.

Trustees, 1 year.

Frank Schimpf, Vandergrift.
H. E. Kottcamp, York.

2 Year Term.

J. D. Sprucebank, Jeannette.
C. A. Thomas, Lewistown.

3 Year Term.

Louis Luckhardt, Pittsburgh.
W. J. Crowther, Beaver.

AUXILIARY OFFICERS

Pres.—Daniel C. Boyer (W. F. Potts Son Co., Inc.) Philadelphia.

V. Pres.—W. A. Hartman (Lyon, Conklin & Co., Inc.) Baltimore.

Sec'y.-Treas.—H. S. Criswell (McClure-Johnson Co.) Pittsburgh.

Directors

Warren B. Stoke (York Corrugating Co.) York.

B. A. Morrison (Demmler Bros.) Pittsburgh.

Geo. F. McCrory (W. F. Angermeyer Co.) Pittsburgh.

J. H. Crago (Follansbee Bros. Co.) Pittsburgh.

Sioux City, Iowa, Furnace Ordinance [Part 2]

Warm Air Supply

SECTION 7. (*a*) To determine the size of warm air pipes necessary for each room to be heated the following rules shall be used:

RULE 1. *First Floor Rooms*—

Divide the total area of doors and windows in square feet by 12.

Divide the net wall area in square feet by 60.

Divide the cubic contents in square feet by 800.

Multiply the sum of these three values by 9.

The result is the area of basement pipe in square inches necessary to furnish the required amount of warm air.

RULE 2. *Second Floor Rooms*—

Apply the same rule as for first floor rooms, except to multiply the sum of the three values by 6—instead of 9.

RULE 3. *Third Floor Rooms*—

Apply the same rule as for first floor rooms, except to multiply the sum of the three values by 5—instead of by 9.

(*b*) In multiple or two-family dwellings, rooms above the first floor occupied as living rooms shall be considered as first floor rooms.

(*c*) In dwellings and other buildings where there is no floored attic between ceiling and room, the ceiling shall be considered outside wall surface in determining the area of warm air pipes.

(*d*) No warm air pipes less than eight (8) inches in diameter shall be used, and for runs over twelve (12) feet long and for North and West exposures, the pipe shall be increased in size accordingly. Transition from leader to stack shall be made with a well designed elbow or boot, and no stack shall be less in area than 60 per cent of the required area of the warm air pipe.

(*e*) All registers shall have a free air area at least equal to the calculated area of basement pipe.

(*f*) The size of furnace to be installed shall be such that the free air area shall at least be equal to the combined area of all warm air pipes attached thereto as determined by the foregoing rules as set forth above in this section and found necessary thereby to furnish the required amount of warm air for the building in which such furnace is to be installed.

Cold Air Ducts

SECTION 8. (*a*) The air supply for the furnace in any warm air heating plant may be taken from the outside of the building or from the inside of the building, or from both, but in no case shall the air supply for a furnace be taken from a cellar, coal room or unfinished basement or from the room in which such furnace is installed.

Provided, however, where a furnace is installed in a room used for the assemblage of persons, the air supply may be taken from such room provided the same is properly ventilated.

(*b*) When taken from the outside of the building the cold air duct or intake shall have a net area throughout its entire length of not less than 80 per cent of the combined areas of all the hot air pipes taken from the furnace.

(*c*) The cold air intake or return when taken from the inside of the building shall have a net area throughout the entire length of the same not less than the combined areas of all the warm air pipes taken from the furnace.

This area may be maintained in one or more ducts, but must not be reduced or contracted at any point.

(*d*) Underground ducts or main leaders shall have a net area equal to the combined area of all the ducts leading into the same, and no duct shall be reduced at any point so that the net area shall be less than the combined computed area.

(*e*) Connections of cold air ducts or boots to furnace casings shall be made so that the top of boot or connection will not be above the top of ash pit or above the level of the grates of such furnace.

(*f*) Where cold air grills are placed in side walls or in front of box seats, the grill must extend to the floor line.

(*g*) Cold air ducts shall be constructed of metal, tile or other incombustible material where they enter the furnace casing, and at least for a distance of twenty-four (24) inches in a horizontal direction from the said casing, and all exposed parts of cold air ducts shall be constructed of sheet metal with dust-proof joints, and all underground ducts shall be plastered with cement plaster throughout their entire length.

Smoke Pipes

SECTION 9. (*a*) No metal smoke pipe from any warm air furnace, stove or other domestic heating apparatus shall pass up through the floors or roof of any building in which they are installed, but shall enter the permanent chimney in the story in which such stove or heating apparatus is installed.

(*b*) No such smoke pipe shall be placed within eighteen (18) inches of any woodwork or plastered partitions having wood lath unless such woodwork or partitions are protected with ⅛-inch cell asbestos paper covered with tin, the tin to be so placed as to give a clear space of at least two inches between the tin and wood, and all non-fireproof partitions to be covered with metal lath and plaster.

(*c*) Smoke pipes shall enter the permanent flue through thimbles of cast iron or sheet metal of not less than 24 U. S. Standard Gauge placed not less than eighteen (18) inches below the ceiling, where the same is of non-fireproof construction. Thimbles shall have a collar on each end of the same and shall be securely fastened in place, and all space in the brickwork around the same shall be slushed full with cement mortar and joints made air tight.

When special permission is given, pipes 8 inches or less in diameter may pass through non-fireproof partitions if properly protected with ventilating thimbles having a two (2) inch air space all around the same, and in addition a fireproof panel shall be constructed in the partition around such smokepipe measuring at least eight (8) inches in all directions from such pipe.

(*d*) Smoke pipes shall be as short and direct as is consistent with the location of the furnace, but in no case shall they exceed fifteen (15) feet in length from the furnace to the permanent flue. They shall be made of either black or galvanized iron not lighter than No. 24 U. S. Standard Gauge, and of the full size of the collar on the furnace throughout its entire length. It shall have no other openings for attaching any fire place, stove, range, water heater, gas or ventilating, connections. It shall be lock seamed or riveted, all joints shall lap not less than one and one-half (1½) inches, and it shall be rigidly secured.

Chimneys

SECTION 10. (*a*) The owner of every building in which a warm air furnace is to be installed shall provide a chimney constructed in a manner to comply with the following specifications.

(*b*) The chimney must be absolutely smoke tight throughout the entire length and must extend from a point three (3) feet below the bottom of intake or smoke pipe to a point at least three (3) feet above the fire wall of a flat roof, or two (2) feet above the ridge of a pitched roof.

(*c*) If built of a single thickness of brick or cement blocks it shall be lined from a point twelve (12) inches below the intake for smoke pipe throughout its entire length and four inches above the top, with tile flue lining of not less than three-fourths inch in thickness with joints well fitted and laid up in cement mortar. If necessary to offset the same it shall be done in a manner that will not reduce the net sectional area of the same or create a ledge or obstruction upon which loose material may lodge.

(*d*) Every flue shall be provided with a cast iron clean-out door at the bottom of the same and with the exception of the opening to which furnace is attached there shall be no other openings for attaching any fire place, range or water heater

or other heating apparatus or gas or ventilating connections.

(*e*) The net area of a chimney flue to which a furnace or other heating apparatus is to be attached shall be 25 per cent greater than the area of the smoke pipe attached thereto, but in no case shall the net area of such flue be less than eighty (80) square inches, or 8 inch by 12 inch, commercial size.

(*f*) Provided, however, that the size and height of chimneys for heating plants other than one- and two-family dwellings shall conform to the standard practice of heating and ventilating engineers.

(*g*) Where the location of a chimney is such that the draft is impeded by adjacent buildings, surrounding hills, or other objects, or the direction of air currents, then the Building Inspector may require the owner of such chimney to extend the same to a greater height, or install such mechanical device as may be necessary to properly regulate the operation of such flue or chimney.

Inspection

SECTION 11. (*a*) Inspection of work shall be made by the Building Inspector or an assistant to the Building Inspector who is educated or experienced in furnace work, and shall be made as follows:

In new work, inspection shall be made when stacks to the upper floors and the heads for all side wall registers have been installed, and the boots have been placed, and it shall be the duty of the contractor installing the work to notify the Building Inspector when the work has progressed to this point. Provided, however, in one-story cottages in which there are no stacks extending to the second floor, and where all work is exposed and readily inspected, no inspection shall be required until the plant is completed and the final inspection is called for.

(*b*) The inspector shall attach a certificate to each stack, boot or register, certifying that the work complies with the requirements of this ordinance before such work shall be accepted.

(*c*) Inspection of repairs of renewal work shall be made in each case as the nature of the work requires.

Provided, however, that no second hand furnace shall be installed or set up, until the same has been inspected and approved by the Department of Buildings. And further provided, that contractors making repairs upon furnaces if upon dismantling the same it is found the other repairs are needed than those set forth in Paragraph (c), Section 1, of this Ordinance, it shall be the duty of such contractor to report the matter to the Department of Buildings and procure the necessary permit and inspection as required above for second hand furnaces.

(*d*) Final inspection of work shall be made when notice is given to the Building Inspector that the heating plant is installed, or repaired, and ready for operation, and such notice shall be given in writing before the heating plant is turned over to the occupant for operation.

(*e*) It shall be unlawful for any person to lath or plaster over, or to cover up any heating work before inspection of the work has been made and the certificates of approval attached to the work to be concealed.

The Inspector is hereby authorized to remove any type of covering that conceals such work where the same has been placed before inspection has been made and certificate of approval attached thereto.

Building Requirements

SECTON 12. (*a*) In the construction of new buildings where the same is to be heated with a warm air furnace, the Building Inspector shall require the building to be constructed to meet the following specifications:

(*b*) Where heating stacks, boots and registers are located in partitions parallel to the run of joists, there shall be two extra joists supplied; the same to be placed six (6) inches from the center of partitions on either side of the same, and joists shall be bridged across at intervals of two (2) feet with 2-inch solid bridging the full depth of the joists for the entire length of the partition above. Where such stacks, boots and registers are placed at right angles to the run of joists, the joists between which such stacks, boots and registers are placed shall be no less than sixteen (16) inches on centers, and the joists shall be butted at the ends of the same and not lapped or otherwise placed so as to reduce the clear space for such stack, boot or register to less than fourteen (14) inches, and studding in the partition over the same shall be placed directly over the joists.

(*c*) The studding in new partitions wherein stacks are to be run shall be placed with not less than fourteen (14) inches clear space between the same, and such partitions may be constructed to 2x4-inch studding except in two-family or multiple dwellings having living rooms on the second floor, in which case they shall be constructed of 2x6-inch studding.

(*d*) Except where stacks are placed in the center of six-inch partitions with clear air space on both sides, the space occupied by such stacks shall be covered with metal lath.

Where stacks are placed flush with one or both sides of any partition such flush side shall be covered with metal lath.

(*e*) Installation of new work in old houses shall in general conform to the provisions of this ordinance for new house work except that it will not be necessary to remove lath or plaster from walls wherein stacks are to be run, or to run stacks in six (6) inch partitions, provided such stacks can be locked together and shoved in place either from below or above.

(*f*) For the purpose of this ordinance an old house shall be considered as one that has been completed and occupied before the passage of this ordinance.

Violations

SECTON 13. Any person, firm, or corporation violating any of the provisions of this ordinance shall upon conviction thereof be fined in the sum of not less than twenty-five dollars ($25.00) or more than one hundred dollars ($100.00) and the cost of prosecution.

Repeal

SECTON 14. All ordinances and parts of ordinances in conflict herewith are hereby repealed to the extent of such conflict.

Passed March 7, 1925.
Approved March 7, 1925.

STEWART GILMAN, *Mayor.*

F. A. GARNSEY, *City Clerk.*

[Part 3 will follow]

Fox Valley, Illinois

The Fox Valley Furnace and Sheet Metal Contractors Association (Illinois), held their annual field day at the Bartlett Hills Country Club, 5 miles east of Elgin, on July 13.

Events of the day included a golf tournament; soft ball game—contractors vs. supply men—with Fred Lamp and Paul Hudgens of the Elgin Sheet Metal Works acting as co-chairmen; horseshoe tournament—Walter Eissler (the defending champion cup up for competition) and Phil Ries of Aurora were co-chairmen; cards with Don Glossop and Rolland Youngren of Aurora as co-chairmen; chicken dinner at 7 p. m.

Burrell Conover, 638 S. Broadway, Aurora, was chairman of the Day.

Jack Stowell, President.

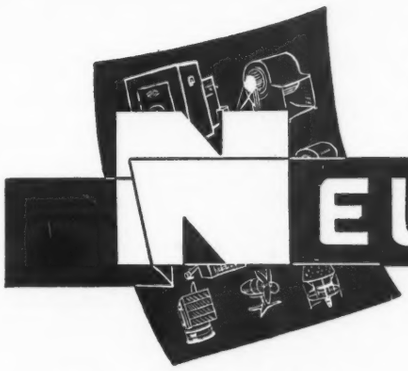
Chicago

The annual Central Committee Banquet held recently in Stickney, Illinois was a great success.

D. C. Ellison acted as toastmaster and chairman of the event, with John Novak assisting him as treasurer and co-chairman. Louis Drehobl was in charge of the banquet, assisted by Messrs. Ellison and Novak. A delicious four course dinner was served.

The guests later were entertained by a magician.

With the drawing of the door prizes, the lucky winner of the ladies' first prize was Mrs. Woodruff of Wilmette, Ill. Second prize went to Mrs. Kerwin of Chicago. L. Drehobl's name was drawn for the men's prize. C. Den Besten was presented with a cast iron "chicken fryer" on behalf of the Central Committee to help commemorate his anniversary on that date.



For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 92 and mail to us. Complete information will be forwarded.

● Indicates product not listed in 1938 Directory.

△ Indicates product and manufacturer not listed in 1938 Directory.

NEW PRODUCTS

123—Cast Fan Wheel

Advance Aluminum Castings Corporation, 2742 West 36th Place, Chicago, is making a new type blower fan with the hub cast to form the driven unit of a flexible coupling. This fan marketed under the trade name "Castalu" is designed for service on oil burners, stokers, air conditioning equipment and many other devices.

It is also possible to obtain this blower with grooved hubs for belt drive, with hubs of the single, double or triple groove type, cast as an integral part of the fan.

Test samples of standard blowers may be secured by writing the maker giving diameter, width, bore and direction of rotation.

◆

124—Gas-Fired Aire-Flo

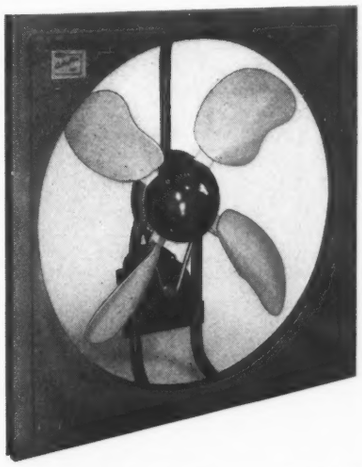
The Lennox Furnace Co., Inc., Syracuse, N. Y., announces the new Lennox Gas Aire-Flo air conditioner, at a low cost.

The specially designed heater is made of durable copper-bearing steel electrically welded. Burning gases travel from the top of the radiator to the bottom and back again before reaching the manifold in the flue connection. The large manifold is so placed that the full volume of air strikes it directly and captures most of the heat remaining in the burning gases.

The cabinet is well proportioned with rounded corners, and finished in a two-toned baked enamel. The blower is oversized. Motor speeds are adjustable for winter, spring and summer operation. The humidifier has a number of ceramic evaporator plates. Filter area is sufficent for efficient air cleaning—glass wool coated filters are used. Controls are automatic.

● 125—Attic Fan Unit

The Arco Cooling Fan Division of American Radiator Company, 40 West 40th St., New York City, is introducing a new attic fan unit, complete with all necessary parts, to be quickly and easily installed by a heating contractor.

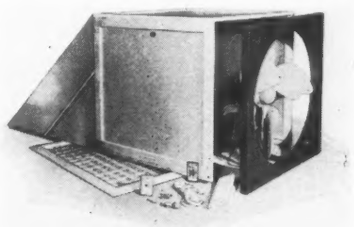


A feature is a device to be known as the Auto-Timer, which starts and stops the fan automatically.

◆

126—CirCOOLator Package

Viking Air Conditioning Corp., Main and Center St., N. W., Cleveland, announces advances and new designs in the 1938 model Viking CirCOOLator now being marketed as a complete attic package in three sizes—32, 40 and 48 delivering 7,500, 11,500, 16,500 cfm. respectively.



The ceiling grille, automatic timer, fusible link, air duct, ropes, fittings, switches, nuts and bolts, are included with every unit.

The new free-air ceiling grille is said to increase to over 90 per cent the unrestricted air flow efficiency through the grille.

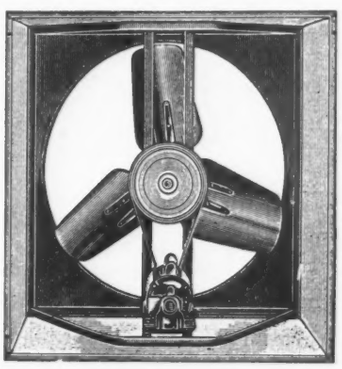
Other new features include a fireproof trap door connected by a fusible link that will melt in case of fire downstairs, automatically closing the door and stopping the fan; sound absorbing straightening chamber and air duct, constructed of 5 layers of jute board separated by 4 dead air spaces, swishing noises caused by unequal air currents entering the fan have been reduced below the audible stage; helixoid impellor, a new design which decidedly increases aero-dynamic efficiency.

◆

● 127—Home Cooler Fan

The Emerson Electric Manufacturing Company, St. Louis, announces a new 42-inch, 2-speed, home cooler fan.

The Emerson-Electric Home Cooler fan's distinctive features include a 2-speed capacitor-start, induction-run, resilient-mounted motor with built-in thermal overload motor protector. This motor requires less than 20 amperes with armature blocked on 110 volt 60 cycles current, making it applicable to the average home wiring circuit. The fan shaft is mounted on special thrust-type ball bearings which are also cushioned on rubber. The fan case, in which the fan is shipped, forms a part of the plenum chamber.



The fan operating in free air, on high speed at 275 rpm delivers 12,800 cfm. On second speed, the fan operates at 185 rpm and delivers 8,600 cfm.

Accessory items include ceiling grille, automatic shutter and plenum chamber (suction box).

◆

128—Air Circulator Blades

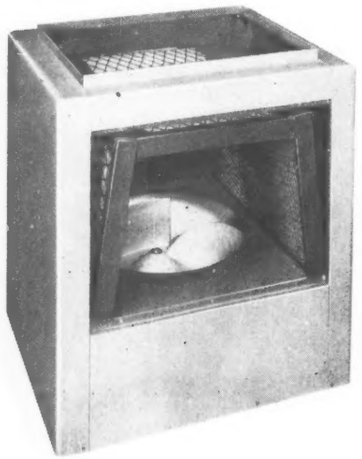
The Torrington Manufacturing Company, 20 Franklin Street, Torrington, Connecticut, has added a 20 in. blade to its well-known Airistocrat line. Of modern design, this blade produces at recommended speeds a high velocity air stream effecting deep penetration with unusual quietness. The company's well-known Airistocrat line of fans now includes sizes 8, 10, 12, 14, 16, 18, 20, 24, and will soon include a 30 in. size. These will be followed with 36, 42 and 48 in. sizes.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.

▲ 129—Comfort-Air Circulator

The Home Comfort Co., Harvey, Illinois, is introducing a new circulator —Comfort-Air—in an attractively finished steel housing, which will make

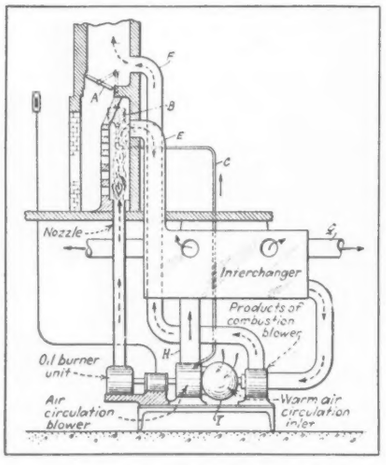


already-installed warm air heating systems complete air conditioning units in winter, and circulate cooler basement air in summer. The Spiroidal fan is the only moving part.

◆

130—Fireplace Heating System

Nathaniel B. Wales, 400 Madison Avenue, New York City, has developed and patented a fireplace heating system. The operating mechanism is placed in the basement and comprises one motor which operates the oil-burning unit, the warm air blower, and the combustion blower.



Assembly of Fireplace Heating System

When the thermostat calls for heat, damper *A* in the chimney (shown closed but normally open when the system is at rest) is automatically closed by the small cloth bellows *B*, which is placed outside the chimney. The bellows is inflated when the motor starts. This is due to the small tube *C*, which is connected to the housing of the warm air circulation blower, and to the fact that the slight static pressure developed by this blower dilates the bellows through the pipe connection *C* and closes the damper. When the system stops, the damper opens by gravity.

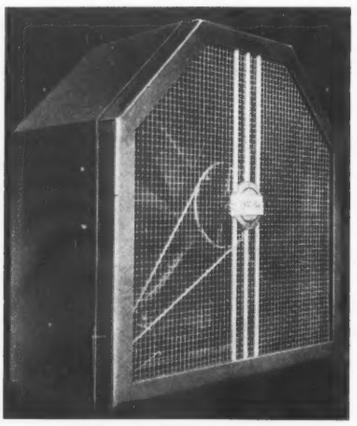
The closing of the damper is coincident with a sub-atmospheric pressure generated in the duct *E* by the combustion blower. The duct opens into the combustion zone in the fireplace proper. The products of combustion are induced downward through the interchanger and, after being cooled, pass through the combustion blower and then to the chimney. The heat interchanger is equipped with conventional warm air distributing ducts *G*, and is supplied from the blower through duct *H*, which is connected with a main air supply duct *I*, either partially or totally recirculated.

This system may be equipped with humidifier and filters and an automatic coal burner may be used.

◆

131—Attic Fan Housing

American Blower Company's (Detroit) Ventura home conditioner brings a new style in attic ventilating fan design, with housing of sheet steel in black morocco crinkle finish, and tapered top



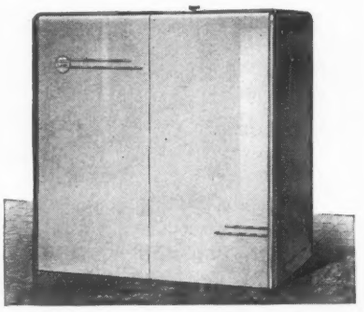
to facilitate installation. A safety guard in the form of an attractive decorative grille is available for open installations.

Lawrence Blazey of Designers for Industry, Inc., Cleveland, was consultant on design and color.

Engineering features to develop quiet operation include streamlined air inlet, rubber mounting of motor, and also rubber mounting of the accoustically treated housing. The unit may be installed in louvred sidewall opening if attic is tight or in suction box over ceiling grille. Six sizes offer cfm range of 7,500 to 21,500.

132—Oil Air Conditioner

The Waterman-Waterbury Company, Minneapolis, announces a new compact model of direct-fired oil-burning air conditioner, particularly recom-



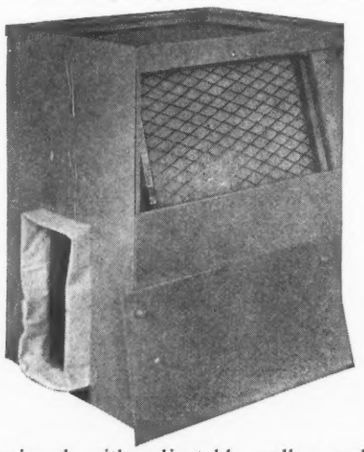
mended because of its midget size (32 x 56 x 55 in.), appearance and trim, accessibility to all parts, blower sets on floor where it can not communicate vibrations through the superstructure of the unit, available with filters for cleaning, or with air washer at slight additional expense, furnished with adequate cooling equipment.

The blower is adequate against resistance of cooling coil and filters.

◆

133—Unipack Blower

American Machine Products Co., Marshalltown, Iowa, announces a new low-priced Unipack blower—1,000 cfm maximum capacity, size 25 x 30 in., and



equipped with adjustable pulley and two 16 x 25 in. filters.

All Am-Pe-Co blowers are equipped with ring-oiler bearing, shaft ends are ground to .002 in. clearance in self-aligning bronze bearing sleeves.

◆

134—Q-T Ductliner

The Celotex Corporation, 919 N. Michigan Ave., Chicago, is introducing a rock wool liner to be employed in air ducts of heating, ventilating and air-conditioning systems. The new product, assigned the trade name of Q-T Ductliner, has been designed to serve a fourfold purpose: (1) The absorption of air-borne noise; (2) the insulation of ducts against thermal loss; (3) the "dampening" of duct wall vibrating or "ring"; (4) the elimination of the "speaking tube" characteristic of duct ventilation.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.

• 135—Automatic Stoker

Wayne Oil Burner Corporation, Fort Wayne, Indiana, is introducing an automatic coal stoker for domestic and industrial installations, priced competitively, and engineered to provide practically laboratory-perfect combustion on the cheaper grades of coal with only simple maintenance over a long period of years.

Tuyeres cast in small segments, located around liberally sized rectangular retort, provide a limited air travel of only three inches, thereby reducing power requirements with combustion efficiency.

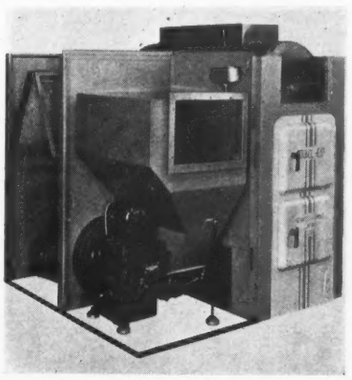
The use of nickel steel gears cushioned in oil make for whisper-silent operation. A thermostat and full automatic controls are employed to provide against the fire going out in very mild weather and to meet with the highest standards of safety requirements.

◆

• 136—Winter Air Conditioner

The Schwitzer-Cummins (Indianapolis) Conditioner consists of a stoker furnace, Stokol stoker, blower-filter air cleaner and circulator, and humidifier, built into a modernistic cabinet, providing automatic winter air-conditioning at a substantial saving in the initial cost of equipment and without sacrificing valuable basement floor space.

The Stokol-Heat unit is available for Stokol bin-feed arrangement or can be furnished in hopper style.

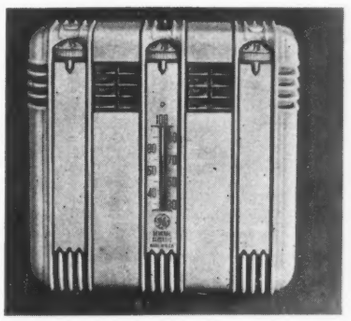


The stoker furnace, available in two sizes with nominal ratings of 130,000 and 200,000 Btu per hour at bonnet, embodies the latest engineering principles of heat transfer. It is a solid steel welded unit. There are no furnace cemented seals from which gases may leak out and extreme care was used in designing combustion space and flame travel so as to obtain the most efficient and economical heating operation. An ample size clinker compartment and clinker removal bucket has also been provided for convenience in cleaning the fire.

• 137—New Control Assemblies

The air conditioning department of the General Electric Company, Bloomfield, N. J., announces a new humidistat which may be installed separately or in combination with a thermostat or night-and-day assembly.

The new humidistat, for the control of humidifying apparatus in the residential field, consists of a multiple human hair element, electrical contacts, and a magnet to cause snap action on



opening and closing of the contacts. It includes a rotating dial calibrated for a range of from 20 per cent to 60 per cent relative humidity. The humidistat is suitable only for low voltage. It is furnished in an antique ivory plastics case with gold trim, and plugs into a wall receptacle.

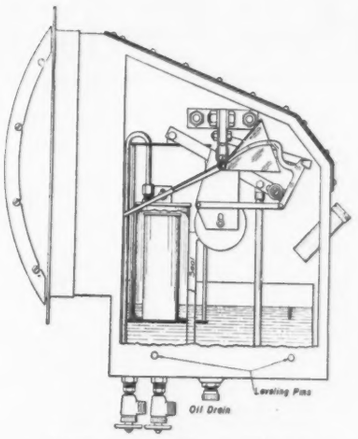
The character and range of the new instruments, including the thermostats, permit group mounting.

◆

138—Relay

General Controls Co., 450 East Ohio St., Chicago, announces a new relay capable of handling single phase motor loads up to 1 h.p. or heating loads up to 1.5 k.w.

The General RS 100 is specifically designed to meet the needs of the automatic heat, refrigeration, and air conditioning industries, according to the manufacturers. A feature is an extra terminal for supplying power to wall clocks, indicating lamps or small sensitive relays.



139—Air Flow Gage

Ellison Draft Gage Company, 214 West Kinzie St., Chicago, Illinois, announces an Air Flow Gage said to give accurate flow measurements of air and gases across an orifice in cfm or cfh on a scale of equal divisions.

Square Root Movement consists of a pointer with camtrack in the counter weight of the pointer, and a cam linked to the gravity arm of the power unit. The pointer is carried on knife edge fulcrum bearings underneath the fulcrum bearings of the power unit. The pointer and track move through 50 deg., 25 above and 25 below a line of horizontal. The track and cam are chromium plated.

Power Unit consists of a powerful gasometer bell, moving within a stationary bell. This differential system eliminates buoyancy loading weight with plus pressure, thereby increasing the sensitivity of the gage. The bell is provided with a seal which prevents the oil from being blown out of the pan under pressure surges in excess of the scale range. The liquid used is a refined petroleum oil of from 36 to 39 deg. B.

The fulcrum knife edges are of steel, case hardened and honed.

Level: The gage is provided with two leveling pins and is leveled with a portable level furnished with the gage.

Fuel-Air-Ratio: This gage with two elements correctly proportions the air and gas flow.

Accuracy: With 4 in. differential pressure the gage repeats perfectly down to .06 in. differential.

◆

140—Anthracite Stoker

Cooper & Cooper, Inc., Pittsfield, Mass., is offering the Cooper anthracite stoker for furnaces or boilers on a convenient payment plan.

This stoker is built in three sizes, with Acratherm control, employing the Minneapolis-Honeywell principle of artificial heat acceleration; new R-19-1 Relay, Pressuretrol, Aquastats, and Airstats, for hold fire and high limit. A bin-feeder attachment with pit type installation is available.

Ashes drop from the burner directly into the ash can beneath. A new type Cooper deflector baffle offers greater fuel savings at a slight additional cost.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.

141—Naylor Steel Furnace

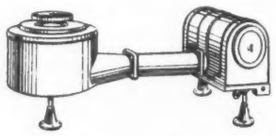
Naylor Corporation, Air Conditioning Division, 1230 East 92nd St., Chicago, is producing a steel furnace in five models, 65,000 to 150,000 Btu.

The shell is of grade A steel, double electric welded Naylor spiral lock-seam pipe. The head is ¼-in. thick. The casing is square with rounded corners—easy to assemble. A large cast iron pan humidifier is located between fire door and ash pit door.

◆

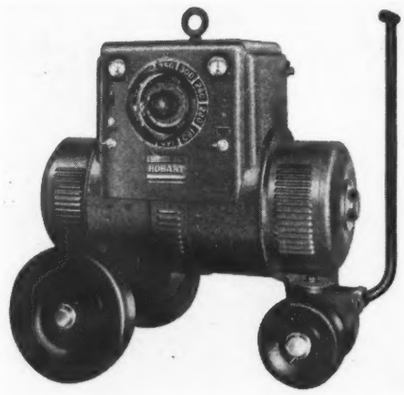
▲142—Par Oil Burner

Par Appliances, Inc., LaCrosse, Wisconsin, is producing the Par oil burner, the only moving part of which is a small 1/100 h.p. motor and fan. The burner is protected with safety devices and carries full Underwriters Approval.



Fuel oil is converted into gas and burned as a gas. There is a special patented combustion chamber which provides a dead air space at the bottom of the chamber, accomplishing temperature regulation of the casting so that the oil does not crack and form carbon.

The motor and control end of the burner are enclosed within heavy cast iron covers attractively finished with a baked wrinkle enamel.



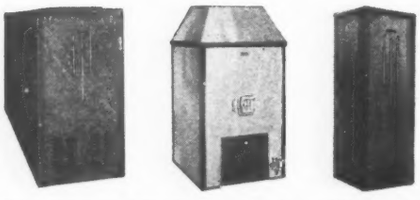
143—Multi-Range Arc Welders

The Hobart Brothers Company, Troy, Ohio, announces a new line of "Multi-Range" arc welders, the keynote of which is "1,000 available combinations of voltage and current."

It is pointed out that the new models embody the same proven principles of control as previous models but that the wide welding range of each machine is now divided into ten ranges with a 100-step, continuously wound rheostat (Volt-Amp Adjuster) operating in each range. The result is said to be a complete absence of "dead spots," closer control of the relationship between open circuit voltage and welding current.

SOLD ..and a Lochinvar in Every one

Lochinvar furnaces are the answer to the heating problems of builders of low cost homes. Mace Properties, Inc., of Washington, D. C., installed a Lochinvar in every one of the houses they are building in Glebewood Village, Arlington, Va. The Mace company as well as other builders, know that Lochinvar builds a furnace to fit into any building budget from $4000 to $15,000—and its dependable and efficient operation pleases the most exacting home owner.



Write today for information and prices about the complete Lochinvar line.

Illustrated opposite main copy is the Junior-Aire, at bottom from left to right, Model 100 A, Model 100 and the Lochinvar Oil Burning Water Heater.

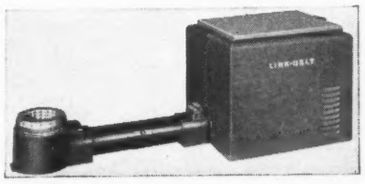
LOCHINVAR CORPORATION

OIL BURNING FURNACES • OIL BURNING WATER HEATERS

14247 Tireman Ave., DEARBORN, MICH.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.



144—Econo-matic Stoker

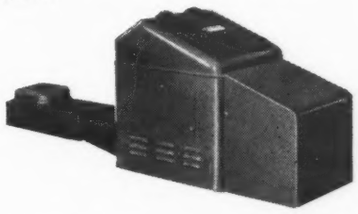
Link-Belt Company, Stoker Division, 2410 W. 18th St., Chicago, announces a completely new 30-lb. automatic coal stoker—the "Econo-Matic"—available for the average home at a very low price.

This model incorporates standard and special design features, such as: No shear pin; overload protection provided by special electrical device; automatic Load-Signal; sectional burning heads, to eliminate cracking from cooling strains; one-piece windbox and retort; all firebox parts made of chrome-nickel alloy; integral airduct and coal feed tube; accessible cleanouts; new inlet type Airmeter with banking feature; Variable Intermittent Drive transmission, with finger-tip speed control (no belts to change); cast iron hopper bottom; integral with air duct, gear case adapter and other parts in a single strong "backbone"; new design hopper, with baked-on finish in two tones of gray ornamented in black, nickel and maroon.

◆

145—New Firetender Model

Holcomb & Hoke Mfg. Co, 1532 Van Buren St., Indianapolis, Ind., announces the Standard, a new domestic model FireTender which comes in two sizes, the 2A and 3½A. The new model was designed to meet the demand for a stoker for small and medium size homes.



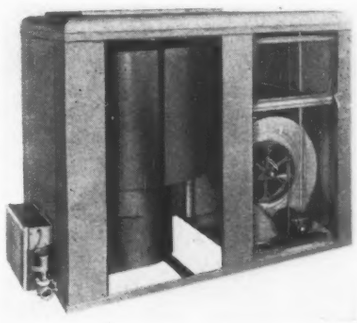
A streamlined, extra large hopper is built low for easy filling—only 25 in. to the bottom of the fill door.

Under the new F. H. A. plan, dealers may sell FireTenders with no down payment.

146—Gas-Fired Air Conditioner

American Gas Products Corporation, 40 W. 40th St., New York City, announces the new AGP air conditioner, Type K,—a direct-fired, forced air furnace, providing a central warm air heating and conditioning system. It heats, humidifies, filters and circulates the air.

There is a heavy gauge Armco, cop-



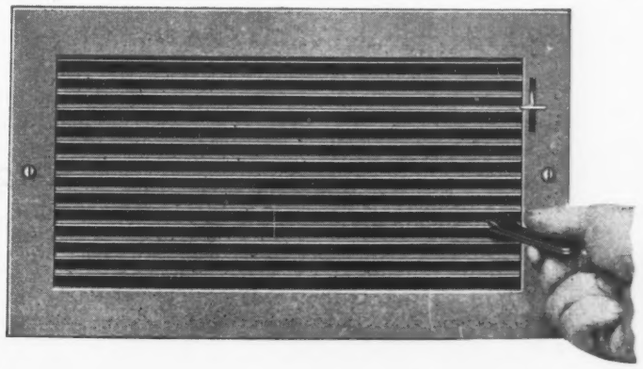
per-bearing steel, heating unit. The radiator section, which is placed around the main heating drum, is well baffled to provide maximum flue travel. The burners are of cast iron with raised drilled ports. The humidifier is of the automatic Thermo-Drip type. Filters are in the fan compartment.

The Type K is made in five sizes,—90,000, 120,000, 160,000, 200,000 and 260,000 Btu per hour input, and is approved by A.G.A. Laboratory. It has gray gunmetal enamel finish.

NEW—Fin-Flex *Adjustable* Registers!

REGISTERS and Intakes of charming, airy, simplicity of design—abundant air capacity for modern forced air systems—yet of rugged, durable construction. Highly flexible as to direction of air—single or multiple current. Blade adjustment, as shown, is quick, easy, positive—secures air flow in any desired direction.

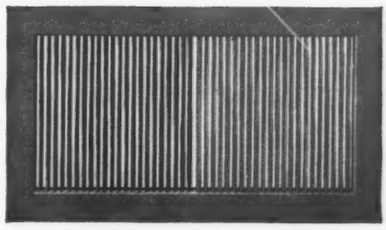
Fin-Flex Wall Registers and Grilles come with either vertical or horizontal fins, in all standard sizes and finishes. Fit for America's finest homes—yet priced for the "small house" market.



●

Ask for New Auer Air Conditioning Register Catalog.

●



THE AUER REGISTER COMPANY, 3608 PAYNE AVENUE, CLEVELAND, OHIO

AUER DISTINCTIVE REGISTERS & GRILLES For Air Conditioning *and* Gravity

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.

141—Naylor Steel Furnace

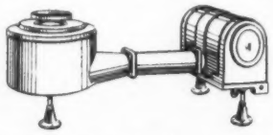
Naylor Corporation, Air Conditioning Division, 1230 East 92nd St., Chicago, is producing a steel furnace in five models, 65,000 to 150,000 Btu.

The shell is of grade A steel, double electric welded Naylor spiral lock-seam pipe. The head is ¼-in. thick. The casing is square with rounded corners—easy to assemble. A large cast iron pan humidifier is located between fire door and ash pit door.

◆

▲142—Par Oil Burner

Par Appliances, Inc., LaCrosse, Wisconsin, is producing the Par oil burner, the only moving part of which is a small 1/100 h.p. motor and fan. The burner is protected with safety devices and carries full Underwriters Approval.



Fuel oil is converted into gas and burned as a gas. There is a special patented combustion chamber which provides a dead air space at the bottom of the chamber, accomplishing temperature regulation of the casting so that the oil does not crack and form carbon.

The motor and control end of the burner are enclosed within heavy cast iron covers attractively finished with a baked wrinkle enamel.

143—Multi-Range Arc Welders

The Hobart Brothers Company, Troy, Ohio, announces a new line of "Multi-Range" arc welders, the keynote of which is "1,000 available combinations of voltage and current."

It is pointed out that the new models embody the same proven principles of control as previous models but that the wide welding range of each machine is now divided into ten ranges with a 100-step, continuously wound rheostat (Volt-Amp Adjuster) operating in each range. The result is said to be a complete absence of "dead spots," closer control of the relationship between open circuit voltage and welding current.

SOLD ..and a Lochinvar in Every one

Lochinvar furnaces are the answer to the heating problems of builders of low cost homes. Mace Properties, Inc., of Washington, D. C., installed a Lochinvar in every one of the houses they are building in Glebewood Village, Arlington, Va. The Mace company as well as other builders, know that Lochinvar builds a furnace to fit into any building budget from $4000 to $15,000—and its dependable and efficient operation pleases the most exacting home owner.

Write today for information and prices about the complete Lochinvar line.

Illustrated opposite main copy is the Junior-Aire, at bottom from left to right, Model 100 A, Model 100 and the Lochinvar Oil Burning Water Heater.

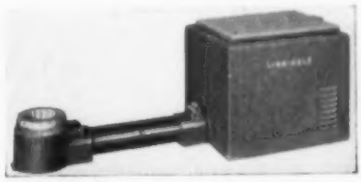
LOCHINVAR CORPORATION

OIL BURNING FURNACES • OIL BURNING WATER HEATERS

14247 Tireman Ave., DEARBORN, MICH.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.



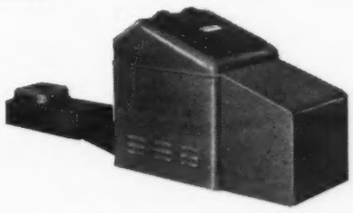
144—Econo-matic Stoker

Link-Belt Company, Stoker Division, 2410 W. 18th St., Chicago, announces a completely new 30-lb. automatic coal stoker—the "Econo-Matic"—available for the average home at a very low price.

This model incorporates standard and special design features, such as: No shear pin; overload protection provided by special electrical device; automatic Load-Signal; sectional burning heads, to eliminate cracking from cooling strains; one-piece windbox and retort; all firebox parts made of chrome-nickel alloy; integral airduct and coal feed tube; accessible cleanouts; new inlet type Airmeter with banking feature; Variable Intermittent Drive transmission, with finger-tip speed control (no belts to change); cast iron hopper bottom; integral with air duct, gear case adapter and other parts in a single strong "backbone"; new design hopper, with baked-on finish in two tones of gray ornamented in black, nickel and maroon.

145—New Firetender Model

Holcomb & Hoke Mfg. Co, 1532 Van Buren St., Indianapolis, Ind., announces the Standard, a new domestic model FireTender which comes in two sizes, the 2A and 3½A. The new model was designed to meet the demand for a stoker for small and medium size homes.



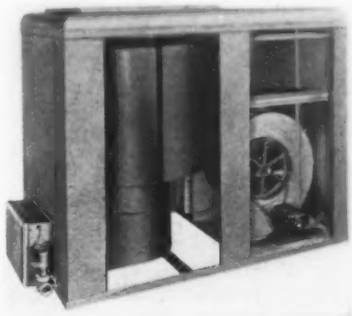
A streamlined, extra large hopper is built low for easy filling—only 25 in. to the bottom of the fill door.

Under the new F. H. A. plan, dealers may sell FireTenders with no down payment.

146—Gas-Fired Air Conditioner

American Gas Products Corporation, 40 W. 40th St., New York City, announces the new AGP air conditioner, Type K,—a direct-fired, forced air furnace, providing a central warm air heating and conditioning system. It heats, humidifies, filters and circulates the air.

There is a heavy gauge Armco, copper-bearing steel, heating unit. The radiator section, which is placed around the main heating drum, is well baffled to provide maximum flue travel. The burners are of cast iron with raised drilled ports. The humidifier is of the automatic Thermo-Drip type. Filters are in the fan compartment.

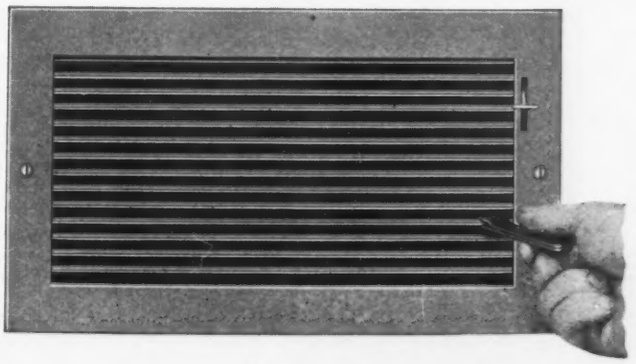


The Type K is made in five sizes,—90,000, 120,000, 160,000, 200,000 and 260,000 Btu per hour input, and is approved by A.G.A. Laboratory. It has gray gunmetal enamel finish.

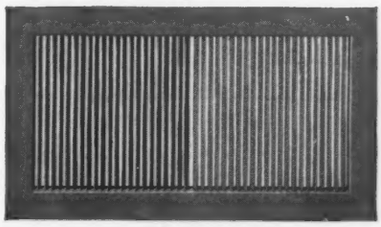
NEW—Fin-Flex *Adjustable* Registers!

REGISTERS and Intakes of charming, airy, simplicity of design—abundant air capacity for modern forced air systems—yet of rugged, durable construction. Highly flexible as to direction of air—single or multiple current. Blade adjustment, as shown, is quick, easy, positive—secures air flow in any desired direction.

Fin-Flex Wall Registers and Grilles come with either vertical or horizontal fins, in all standard sizes and finishes. Fit for America's finest homes—yet priced for the "small house" market.



Ask for New Auer Air Conditioning Register Catalog.

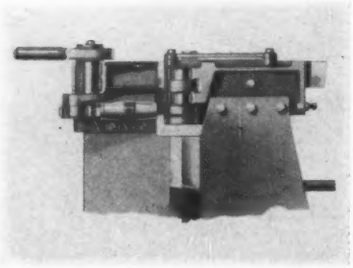


THE AUER REGISTER COMPANY, 3608 PAYNE AVENUE, CLEVELAND, OHIO

AUER DISTINCTIVE REGISTERS & GRILLES For Air Conditioning *and* Gravity

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.



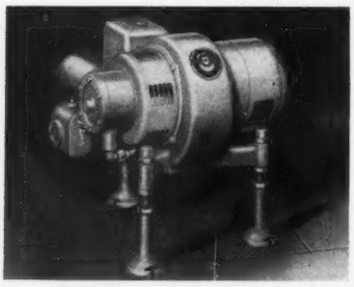
147—Bearing Bending Brake

The Whitney Metal Tool Company, Rockford, Illinois, announces a new Whitney-Jensen bending brake having roller bearings at several important points. Substantial reduction in the effort required to operate the brake is realized, thus speeding up work and cutting down operator's fatigue without diminishing the accuracy or power.

Full-floating, lifetime-lubricated, needle-type roller bearings are to be found in the apron supports, at the upper end of the toggles, and on the eccentric shafts.

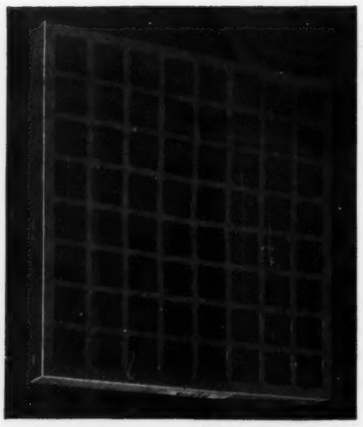
148—Hart Air-Flame

Hart Oil Burner Corporation, Peoria, Illinois, announces a new low pressure oil burner with a rated capacity of three pints to five gallons per



hour, and which burns any domestic fuel oil. This one burner enables the dealer to meet 90 per cent of his domestic oil burner demands.

Features are complete absence of pulsations; elimination of tank hum; safe, efficient, smaller fires; no necessity for priming; and freedom from clogged nozzles, noise and leaks.



149—Flame-Proof Filter

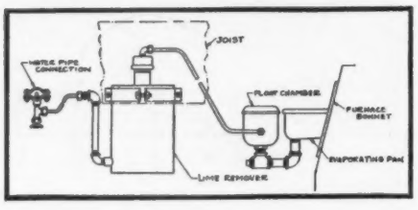
The Independent Air Filter Company, Incorporated, 228 North LaSalle Street, Chicago, is introducing the Permo flame-proof air filter—a throw-away type—which they say has been laboratory and service proved to possess a high average efficiency.

The ladder frame construction is basically founded on a series of individual frame units measuring 20 x 20 x 4½ in., fabricated into rigid vertical ladders. These ladders are constructed one unit wide by as many units in height as necessary. All ladders are factory drilled to facilitate bolting together. Each Permo frame unit accommodates two cells in tandem style.

CLEAN HUMIDIFIERS *Always* WORK

KEEP THEM CLEAN *with a* LIME-REMOVER Skuttle UNIT!

GUARANTEED TO ELIMINATE ALL LIME DEPOSITS



At last, its easy to keep a humidifier clean! Yes, Skuttle's Lime-Remover will entirely eliminate the slime and scale that collects in the bottom of the humidifier pan, often causing faulty operation and costly service calls. It will pay you to learn about this Lime-Remover right away.

WRITE TODAY FOR Skuttle INFORMATION

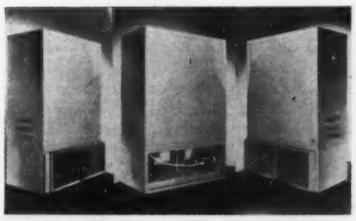
J. L. SKUTTLE COMPANY

AUTOMATIC HUMIDIFIERS

999 FRANKLIN ST., DETROIT, MICH.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 92.



150—Gas Air Conditioner

American Gas Products Corp., 40 W. 40th St., New York City, announces a new AGP air conditioner, Type 1-FP, of the gas-fired parallel-flow type.

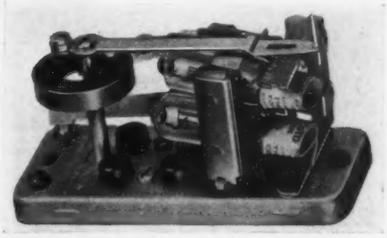
It is made in four sizes—50,000, 75,000, 100,000 and 150,000 Btu per hour A. G. A. ratings—the two smallest designed to meet the requirements of the four to six-room house with or without basement.

The fan-motor compartment is directly under the heating compartment; return air is blown up over the cast iron heating sections in the same direction as, and parallel to, the flow of the hot gases on the inside of sections. Warm air is discharged at top. Return air ducts may be connected to right side, left side, or through the bottom of the unit.

151—Two Stage Sensatherm

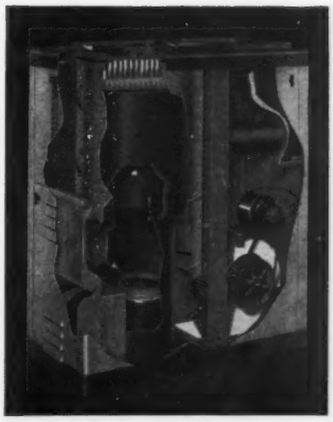
The Mercoid Corporation, Chicago, offers a new type thermostat, known as the two-stage Sensatherm which presents a wide range of applications.

It is especially suitable for room temperature control on high-low fire gas or oil burners. It is also a very desirable control for eliminating overshooting temperatures on stokers with forced circulating warm air systems.



It is also recommended for the regulation of two-speed fans on air conditioning systems.

The Two-Stage Sensatherm is equipped with two dust-proof sealed mercury contact switches, operated by means of one bimetal coil and two permanent magnets.



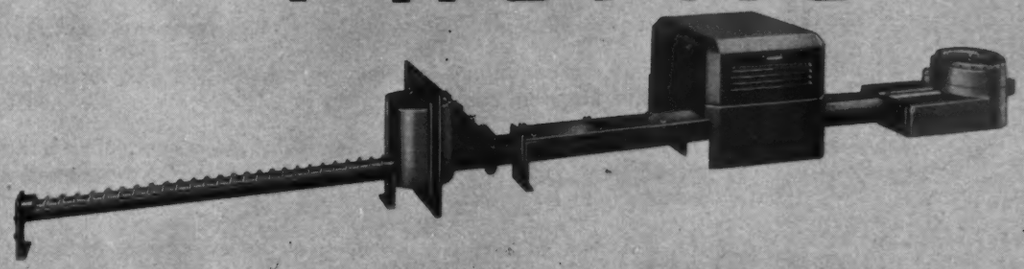
152—Oil-Fired Aire-Flo

Lennox Furnace Company, Syracuse, N. Y., announces the Aire-Flo, an oil-fired air conditioner for small homes. The new Lennox burner operates on pilot flame, medium flame and high flame. The hydroxylating burner is newly designed especially for small homes. (Hydroxilating is the technical word for the process of vaporizing oil and chemically changing this oil vapor first to alcohol and then to formaldehyde which burns without carbon, dirt, smoke or odor.)

The heater is made of leak-proof welded steel. The small combustion chamber is completely surrounded by a steel radiator or secondary heat exchanger through which all the burning gases must travel.

An Invitation

TO PROFITS



THE ENTIRE LINE FEATURES THE MAGIC HAND CONTROL

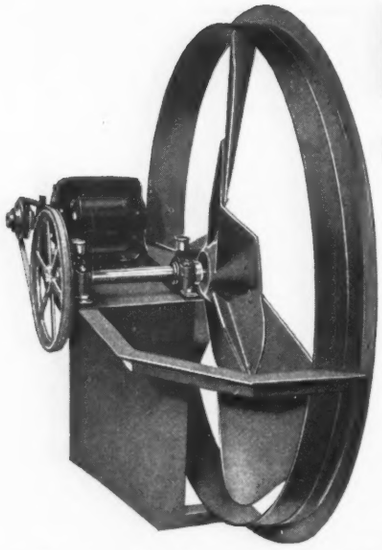
THE MARVELOUS BIN FEED MODEL—ONE OF CONCO'S TEN STOKER MODELS

By Representing CONCO STOKERS . . . .

SOME TERRITORIES STILL OPEN—WRITE US FOR DETAILS

CONCO-SAMPSEL STOKER CORPORATION, MENDOTA, ILLINOIS

DIVISION OF H. D. CONKEY AND COMPANY BOX 1115



NITEAIR ATTIC FANS

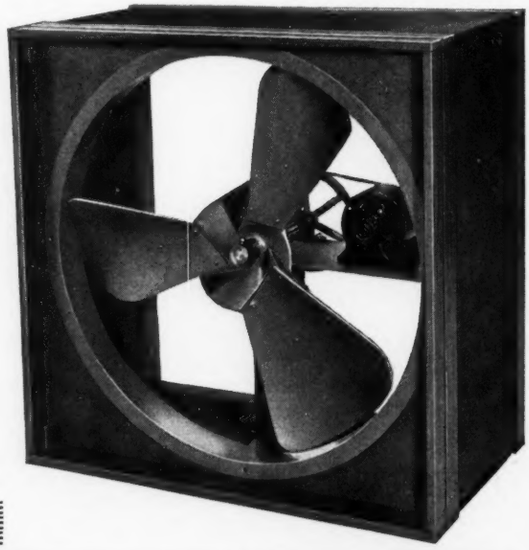
Sizes: 30-in. to 54-in.

Capacities 5,000 to 20,000 c.f.m.

Niteair brings every home owner summer cooling at a price that is easily within their reach. And, YOU can make a BIG PROFIT on every installation. Write now for complete catalog and prices on Niteair Attic Fans.

A New Sales Plan!

A radically new method of presenting summer cooling to your prospects. A plan that clinches sales.



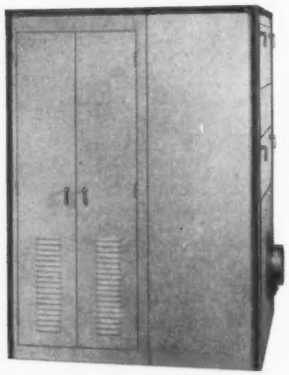
Complete With All Accessories

- Automatic or stationary louvers.
- Free area grilles of sufficient face area
- Automatic control — requires no current — never needs winding.
- Suction box
- Quickly and easily installed

The Lau Blower Company
Dayton, Ohio

HESS EQUIPMENT

FILLS EVERY REQUIREMENT TO INCREASE BUSINESS AND PROFITS



The Hess Climate Master includes the Hess Automatic Oil Burner and controls also centrifugal blower and filters, all under one casing, attractively enamelled.

- Prices are low—for superior quality and value.
- Attractive finance plan—36 months—no recourse, no holdback.
- Real dealer cooperation—territory protection—free plan service—free attractive literature for dealers' help in selling.
- Hess Welded Steel Furnaces, for any fuel, have many quality features, are different and better. Why compete with mail order houses with ordinary types?
- The Hess line is complete, including automatic oil burners and coal stokers, furnaces for any job—large or small.
- Thousands of burners and stokers are being sold for homes. Any dealer can sell them and increase business and profits.

WRITE FOR DEALER PORTFOLIO TODAY

HESS WARMING & VENTILATING CO.
FOUNDED 1873 1211 S. WESTERN AVE. CHICAGO, ILL.

N. W. A. H. & A. C. Convention

(*Continued from page* 42)

ation out of every 24, so the operation of the entire system during the time when the stoker was not operating greatly affects the overall efficiency.

Romance of Iron and Steel

At the Wednesday morning session, the American Rolling Mill Company showed its moving picture, "The Romance of Iron and Steel," which has been shown before most of the state associations during the past two years.

Cooling Controls

Following the movie, G. D. Kingsland of the Minneapolis-Honeywell Regulator Company, on the subject "Cooling Controls for the Residence," said in the eyes of the public residential cooling is still an expensive luxury which accounts in some measure for the small increase in residential cooling installations for 1937 over 1936. A successful control system for cooling, according to the speaker, must be simple and inexpensive and must regulate conditions within the space to be cooled. The system, although not perhaps the individual units themselves, must be adaptable for cooling by cold water, mechanical refrigeration, air circulation or combinations of these. Mr. Kingsland showed many diagrams of typical cooling control instruments and electrical hookups, and if possible this discussion will be presented in full with illustrations in a later issue.

Status of Warm Air Heating

Edwin A. Jones of the Mueller Furnace Company, "Let's Maintain the Position the Industry Now Enjoys," declared that our industry is not competitive in the sense of one manufacturer or one contractor with another, but all should be partners in a co-operative effort to advance our business. That, businesses and industry are no better than the integrity of the individual or the company or the industry. As an industry, warm air heating is on trial by the public and we should not sacrifice our present standing by unfair practices or internal warfare. Our real competition today is between the warm air heating and the automobile; warm air heating and the radio; warm air heating and the moving picture.

Mr. Jones declared that sales without satisfactory engineering has always and will always lead only to trouble. As an industry, and as individuals, we should put forth every effort to stick to the truth and avoid the sale of gadgets. If every contractor and every manufacturer and the industry as a whole, makes sure that every job sold is satisfactory from the owner's standpoint and possesses

WE BUILT A SWEAT BOX
to torture Humidistats

FROM ARID SAHARA TO A STEAMING TURKISH BATH . . . . IN AN HOUR

In this sealed chamber, Penn engineers manufacture weather . . . relative humidities from near zero to saturation at all temperatures, from the cold of a quick-freeze chamber to the sizzling heat of a prairie summer day. Here, controlled drift of air is so small that it can be measured only with a super-sensitive "hot wire" anemometer.

Into this chamber go newly designed humidistats. "Torture them," were orders from the research chief. "Then see if they can 'come back' and *regulate* humidity at recognized comfort levels—30 . . . 35 . . . 40 percent. And, to the junk heap with designs and constructions that can't 'take it'!"

Every Penn control goes through this sort of intensive laboratory testing. Then comes field testing to make doubly sure of satisfying performance. Penn controls add prestige and reliability to your product . . . eliminate excessive service and installation expense.

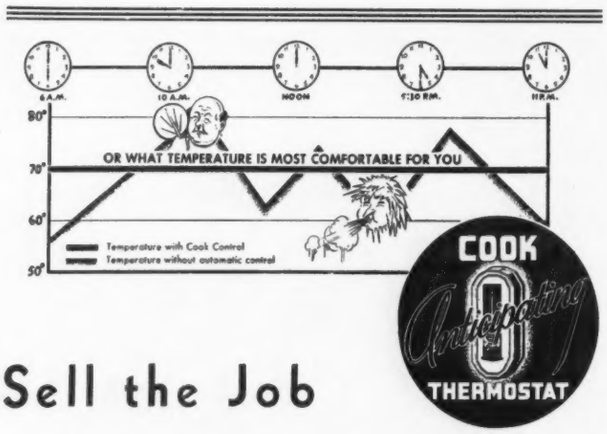
PENN ELECTRIC SWITCH CO
GOSHEN, INDIANA

In Canada, Powerlite Devices, Ltd., Penn Electric Switch Division, Toronto, Ontario. Branches, Factory Representatives and Distributors in all principal cities

PENN

Penn Electric Switch Co., Dept. H
Goshen, Indiana. Mail us your catal
on heating controls, and your interest
Home Comfort Guide moving demonstrat

Name.....
Street.....
City..... State.....



Sell the Job

Complete

with Automatic Control

The installation of a Cook No. 12 Heat Control on a warm air heating job is the finishing touch that completes the job and makes it RIGHT!

It adds an extra profit which you should have. And it adds that extra value which makes all the difference in the world in the customer's enthusiasm over the job you have done.

Remember, the Cook Control is effective with all three—coke, anthracite and bituminous coal. It is easy to install. Dependable and economical in operation. Has many exclusive advantages, including the firing clutch which prevents smoke-back when refueling, quiet operation and safety features.

This season, sell the Cook No. 12 Heat Control on all heating jobs you install. It's the profitable thing to do—as we'll prove if you'll write today for full information.

COOK

COOK CONTROLS

THERMOSTATS—FURNACE LIMIT CONTROLS
ZONE CONTROLS—BLOWER CONTROLS

COOK ELECTRIC CO.

2677 Southport Ave. CHICAGO

quality and integrity, the industry will advance and enjoy prosperity. Low-cost houses, according to Mr. Jones are much in the public eye, but heating systems for low-cost houses need not be inadequate or cut quality installations. If every contractor or every manufacturer sees to it that there is profit in every job and is willing to let such jobs go because of a lack of profit, the entire industry will benefit.

Entertainment Features

Two highlights of the association in the estimation of everyone attending were the golf prizes and the buffet dinner and floor show provided by the L. J. Mueller Furnace Company of Milwaukee. The golf prizes were so elaborate and so numerous that the committee in charge of the program decided to award some of the prizes as attendance awards at each of the three sessions.

Some idea of the buffet supper which was served may be gathered from the photograph taken when the rush for the table was at its height. In the weighted judgment of practically every member attending this buffet supper, there was more food, of more variety, on display, and consumed, than at any similar entertainment ever held by or even given to the National Warm Air Association. The precedent set by the Mueller Furnace Company will be difficult to live up to by succeeding entertainment committees. As an unexpected feature of the buffet supper, W. L. Rybolt, immediate past president of the association was presented with a silver cup as an achievement award for one who has "served this industry willingly, untiringly, and well." The cup was awarded by National Sheet Metal Contractor, trade publication.

◆

Attic Fan Installation

(*Continued from page* 64)

shown in Fig. 8. This housing has no attic ventilating door, depending on the pressure built up in the attic to carry away attic air with air from the house. In this housing all framing is on the outside making the inside smooth to the air flow. Some soft building board or insulating board is suggested for additional sound deadening effect.

The air duct of Air Controls, Inc. is a ready cut unit shipped knocked down and assembled in the attic. The completed housing, shown in Fig. 9 has a metal frame and sheet metal panels. The sloping top acts as a trap door for service or for access to the attic (the grille has to be taken out from below) and the lower halves of both sides are hinged to swing down and close off the grille or ventilate the attic. When raised, the housing forms an air tight duct between grille and fan. These side panels can be connected by cord and pulleys to the room below and where fire ordinances require a fusible link will drop the panels and shut the grille.

[To be continued]

A Better Job for Less Money and A Complete Line to Choose From

No. 50-F Water-Boy Midget Feeder

No. 57 Auto Water Feeder

No. 51 Midget Water-Boy Feeder

No. 58-Z Maid-O'-Mist Humidifier

No. 58-F Water-Boy Feed Valve with Adjustable Water Line

No. 85-W Improved Water-Boy Safety-Feeder

You can solve your humidification problems economically with dependable Maid-O'-Mist Humidifiers and feed valves.

- Built for long life and to avoid corrosion. Easy to install. Adjustable to individual needs. Automatic in operation.
- Designed to meet a wider range in specifications and prices.

Complete specifications and prices are included in

FREE CATALOG A-7

Send for Your copy today.

MAID-O'-MIST Inc.
AUTOMATIC HUMIDIFIERS
180 N. WACKER DRIVE CHICAGO, ILL.

Bulletins on Power Squaring Shears also available.

Send for this book showing

NEW MODERN DESIGN OF NIAGARA SQUARING SHEARS

for easy foot operation

Just off the presses, this new Bulletin 80-B shows you how the new, modern design of Niagara Squaring Shears gives you easy foot operation, clean, smooth cuts, life-long dependability and economy.

NIAGARA HAND OPERATED ROTARY SHEARS

It also shows the complete line of Rotary Shears designed for the 101 jobs requiring curved pieces for a wide variety of work. Mail this coupon for your copy right now.

Mail coupon for your book

NIAGARA MACHINE & TOOL WORKS
683 Northland Ave., Buffalo, N. Y.

Please send Bulletin 80-B addressed to my personal attention.

Name .....

Concern .....

Street .....

City AA-7-38

With the Manufacturers . .

To Study Labor Laws

Charles R. Hook, president of the American Rolling Mill Company, has been selected by President Roosevelt to serve on the commission to go abroad to study labor laws in England and Sweden.

◆

George B. Riddle

Illinois Iron & Bolt Company, Free-Man Stoker Division, 918 S. Michigan Ave., Chicago, has just appointed George B. Riddle sales promotion manager. Mr. Riddle will have charge of all advertising and sales promotion activities.

◆

Breuer in New Quarters

The Breuer Electric Mfg. Co., formerly at 852 Blackhawk Street, announces their removal on June 1 into a new modern two-story plant and office building covering 20,000 sq. ft. of floor space at 5100 North Ravenswood Avenue, Chicago.

◆

York Oil Burner Company Sold

Thomas Shipley, Inc., has purchased outright all interests in the York Oil Burner Co., Inc.

The York Oil Burner Company, Inc., has manufactured domestic oil burning equipment for nearly twenty years. Six years ago they purchased all of the Lalor patents on industrial equipment, manufactured and created by the late James D. Lalor, one of the foremost industrial oil burner engineers, who started to manufacture this equipment in 1897.

According to A. J. Seiler, the new president of the company, plans are under way for an extensive expansion and merchandising program. The personnel of the reorganized York Oil Burner Co., Inc., will remain intact with E. I. Kraber as vice president, L. H. Brenneman as secretary-treasurer and Lawrence Knapp as general sales manager.

◆

Armstrong Expands

The Armstrong Company, 241 So. Post Avenue, Detroit, manufacturers of plastic cements, putties and specialties, announces the opening of a new manufacturing plant in Dallas, Texas. The Dallas plant will serve Armstrong's expanding business in the mid-south and southwest.

Glisson Wilson, southern sales manager, is in charge of the Texas plant.

◆

Edward F. Klick

Connecticut Blower Company, Hartford, Conn., through Charles H. Keeney, general manager, announces the appointment of Edw. F. Klick, Rochester, N. Y., as their special sales engineer for the sale of their products in New York State. Mr. Klick has had a very broad, technical and practical experience in the blower line.

◆

John F. Nugent

John F. Nugent, 62, vice president of Round Oak Company, died June 12 in his home at 402 West High Street, Dowagiac, Mich., after three and one-half months of illness.

He was born on August 14, 1875, in Tuam, Ireland. His father was an American sea captain and when the son was six months old, the family returned to their home in New York City.

Mr. Nugent had been associated with the Round Oak Company since 1907 and was formerly sales manager. He leaves a wide circle of friends in the stove and furnace industry.

Mr. Nugent is survived by his wife and five children. A son, Richard D. Nugent, is now president of the Round Oak Company.

RYBOLT FURNACES

... FOR COMPLETE SATISFACTION

When you specify and install a furnace or air conditioning unit you want to feel sure that you give the best possible job to your customer. Customer recommendation is a powerful influence in your or anybody else's territory, and with a Rybolt furnace installed you can rest assured you'll get nothing but the finest recommendation.

Rybolt furnaces have over a quarter of a century of fine furnace building behind them and past performances prove them able to meet any heating condition.

Give your customers complete, efficient, and economical installations and watch those orders flow in. Drop us a line today for literature and further information on the Rybolt line.

At left. The Series 600A7 Winter Air Conditioning Unit.

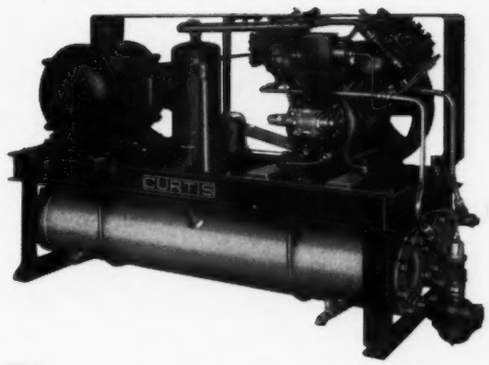
At right. The Series 157 Winter Air Conditioning Unit.

THE RYBOLT HEATER COMPANY

ASHLAND OHIO

Specify

CURTIS for Protection



PROTECT YOUR INTERESTS and those of your customer by making reliability your first consideration in selecting a condensing unit for any air conditioning need—and CURTIS means reliability. For Curtis units are built to deliver years of dependable, trouble-free service and real operating economy under all conditions.

Long life and low upkeep cost, together with highest efficiency are characteristic of every Curtis unit. Curtis engineering created the exclusive "Centro-Ring" method of positive pressure lubrication. Curtis design includes Timken Tapered Roller Main Bearings, water jacketed compressor heads and cylinders, drop forged heat-treated crankshafts and connecting rods, balanced sylphon bellows seal.

There is a Curtis model for every air conditioning and refrigeration requirement, from 1/6 to 30 h.p., air and water cooled. Counter flow, cleanable shell and tube, and evaporative condenser models are available.

The quality and precision with which every Curtis unit is built is the result of 84 years of successful manufacturing experience—including 44 years of specialization in building fine compressors. The result is *reliability*—a product you can sell and recommend in full confidence.

Write today for new Curtis folder on Air Conditioning.

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Company
1946 Kienlen Avenue, Saint Louis, Missouri

CURTIS

THE EXTRA PROFIT LINE FOR YOU!

FURNACE TOOLS *by* FARRELL-CHEEK

HERE'S a side line for you manufacturers and dealers that can easily be turned into your biggest money-maker. A strong complete line of fire tools built to last and with each part particularly designed for the conditions under which it will operate.

Furnished in a variety of sizes, the slice bar, hoe, and fire rake are constructed of cast steel with welded pipe coupling for ready attachment to standard threaded pipe. Slice bars are available with blade widths from one to four inches. Hoes are constructed with thickness from 5/16 to 7/16 inches in various widths. Handles for these tools are of cast steel with welded pipe coupling.

Constructed in three sizes from 42 to 72 inches long, the new clinker tongs are designed for easy handling, sure grip and long use.

Send in now for a sample order. Stock the Farrell-Cheek line and make real money all year 'round. Drop us a line today for further information.

FARRELL-CHEEK STEEL CO.
SANDUSKY, OHIO

With The Manufacturers . . .

Maurice J. Murray

Conco-Sampsel Stoker Corporation of Mendota, Illinois, announces the appointment of Maurice J. Murray, of Bloomington, Illinois, as assistant sales manager.

◆

Mercoid New York Office Moves

The Mercoid Corporation, Chicago, announces the removal of its New York office from 90 West Street to the J. C. Penney Building at 330 West 34th Street, with parking facilities and loading platforms.

R. Fenton Fisher is vice-president in charge.

◆

Marley in Atlanta

The Marley Company, Kansas City, Kansas, water cooling equipment manufacturers, opened their Southeastern sales branch in Atlanta, Georgia, recently. T. A. Tobin, formerly of the home office sales staff in Kansas City, is in charge. The new office is located in the Walton Building.

◆

Elgo Appoints Sales Manager

Elgo Shutter and Manufacturing Company, Detroit, Michigan, announces the appointment of Earl A. Soules to the position of sales manager. Prior to joining Elgo, Mr. Soules was for four years sales engineer of the Aire-Foile Fan & Blower Co., Detroit.

◆

Hoersting & Holtmann Move

The Hoersting & Holtmann Co., manufacturers of Gem City furnaces, announces their removal from 1133 West Third Street to 420 North Main, Dayton, Ohio. At the new location they will have more spacious quarters with a fifty-foot show window and forty feet on a side street. E. J. Hoersting of this firm advises that he has been a reader of American Artisan for 50 years.

◆

Anthracite Class Visits Laboratory

The New York Class of the Anthracite Industries Merchandising School, which has been meeting two evenings a week since May 3rd, visited the Laboratory and Merchandising School Building at Primos and the Permanent Anthracite Exhibit in Philadelphia recently. The visit was for the purpose of inspecting at first hand the new developments in Anthracite-burning equipment for automatic heating, winter air conditioning, water heating, cooking, heating residential and commercial buildings.

The class, which numbered 110 men, includes officials and employees of many of the leading coal firms in and around metropolitan New York.

◆

Gilbarco Dealers' School

Approximately three hundred dealers attended the recent dealers' school, held in Springfield, Massachusetts, by Gilbert & Barker Manufacturing Company. The program included oil heating engineering, installation cost and its relation to selling price, the Gilbarco finance plan and retail selling.

A Sales Booster because it is a Performance Booster !

More Efficient Ventilation–

The new Swartwout Rotary is the scientific product of years of ventilation experience and research — the latest development in gravity ventilation. Its performance under all conditions is remarkably efficient.

Better Satisfied Customers–

Your future sales depend upon present satisfaction of your customers. The better satisfied—the more "sold" they are on your service. By recommending and installing the new Swartwout Rotary you MAKE friends—not lose them. Write for prices and literature.

THE SWARTWOUT COMPANY
18615 Euclid Avenue, Cleveland, Ohio

The NEW Swartwout ROTARY BALL BEARING VENTILATOR

Moncrief

THE *Easier* WAY TO PROFITS

Every job in your neighborhood holds money-making possibilities when you sell the complete Moncrief line of furnaces and winter air conditioners.

Easy to sell because they lead in beauty of design and sound construction.

Easy to install because careful accurate finishing before shipment makes erecting a simple matter.

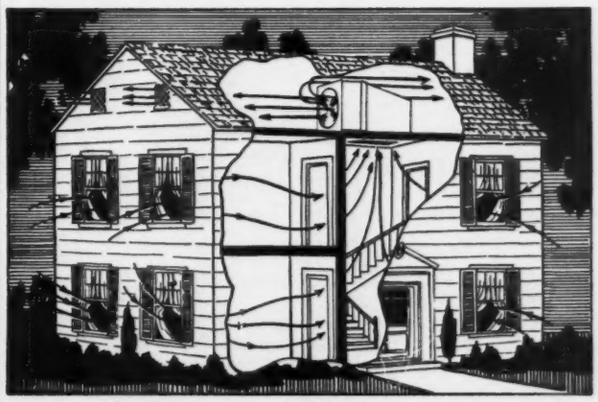
Easy to finance because of the Moncrief Special Finance Plan—No red tape.

Easy to figure—our Engineering Department is glad to help you estimate and lay out plans.

Send for details of the profit-making Moncrief Proposition.

THE HENRY FURNACE & FOUNDRY CO.
3473 E. 49TH ST. CLEVELAND, OHIO

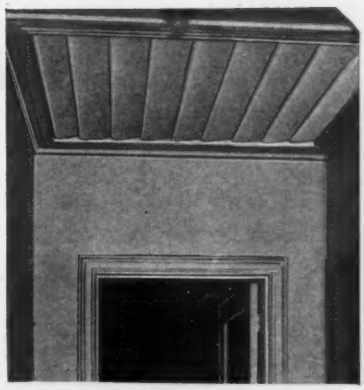
Moncrief supplies EVERYTHING used on a warm air heating and air conditioning job.



No Flapping Doors

WITH THE REX AIRATE ATTIC VENTILATOR

A unique feature of the REX-AIRATE attic ventilator is the automatic ceiling shutter. This shutter consists of lightweight aluminum blades that open when the fan is started and close tightly when the fan is stopped, forming a positive heat-proof seal between the home below and the attic above.



Priced for Big Profit

Everywhere the public is interested in attic ventilation . . . buying attic ventilators. You can cash in on this big market . . . provide real efficient home cooling at surprisingly low cost—and at a good profit to yourself with the REX-AIRATE.

And Remember—REX-AIRATE is the latest and most advanced in "packaged" attic ventilators—NO EXTRAS TO BUY—the unit is shipped complete, ready to install, with all metal fire-proof vent-box, automatic ceiling shutter, fan unit, ceiling moulding and canvas connector.

There are also REX-AIRATE models for commercial business establishments of all types.

This Coupon Will Bring the Story—Mail It!

AIR CONTROLS, INC.
Div. of The Cleveland Heater Co.
1933 West 114th St., Cleveland, Ohio

Name .....

Address .....

City ..... State .....

A. A. 7-38

Economair
Baseboard
Register

It's the
ECONOMAIR
where Price is a Prime Factor!

To meet the growing demand for a high grade air conditioning register at a low cost Tuttle & Bailey engineers evolved the Economair. Simple yet dignified in appearance, this register combines beauty with efficient operation. The open mesh and fine fretwork provide 84% effective area.

The Economair A. C. register is manufactured in large quantities on the most up-to-date equipment. By this means production costs are reduced without affecting the high T & B standard of quality. A complete line of side wall and baseboard registers and intakes is carried in stock for immediate delivery.

AIR CONDITIONING
AND GRAVITY
REGISTERS, INTAKES
AND CONTROLS

T & B
Trade Mark

BOSTON NEW YORK
PHILADELPHIA
CHICAGO

TUTTLE & BAILEY, INC.
NEW BRITAIN, CONN.

News Items . . . . . .

Detroit

The Detroit Association of Master Plumbers, the Steel & Metal Erectors Association, and the Sheet Metal & Roofing Administrators are among the 18 Detroit construction industry associations which recently formed the Construction Industry Joint Committee.

Purposes of the organization are to act in all civic, state and national movements as the representative of Detroit's building industry; to function as arbiter in all internal problems of the construction industry; to resist the encroachment of government upon the construction field, and to maintain close contact with municipal departments as well as state and federal agencies with a view of protecting local industry against out-state competition.

Other groups which are represented on the Committee are: Detroit Chapter, American Institute of Architects; Michigan Society of Architects; Producers' Council Club of Michigan; Builders' & Traders' Exchange; Greater Detroit Home Builders' Association; General Builders; Mason Contractors' Association; Carpenter Contractors' Association; Detroit Ornamental Iron, Bronze & Wire Club; Detroit Electrical Contractors' Association; Detroit Plate & Window Glass Jobbers' Association; Material Dealers Credit Exchange; Wholesale Plumbers Supply Association, and Detroit Paint, Varnish & Supplies Dealers.

◆

Hampden in New and Larger Plant

Hampden Cornice Works, Inc.,—David A. Ouimette and George T. Geoffrion—sheet metal and roofing contractors, announce that on and after June 15, 1938, their office and place of business will be located at 218-226 St. James Blvd., Springfield, Massachusetts. The new location provides a new, modern up-to-date plant with additional floor space.

Obituary

James E. Young, a retired heating and plumbing contractor of Fairfield, Minn., passed away recently at his home in that city, at age of 63.

◆

The death is reported of Homer N. Child, Sr., aged 72, a retired heating and ventilating engineer of Des Moines, Ia., of which city he had been a resident for twenty years.

◆

Joseph L. Colombo, 67, who operated the Colombo Sheet Metal Works at Wausau, Wis., for 20 years prior to his retirement in 1925, died June 5 at a Milwaukee, Wis., hospital after an illness of two weeks. He is survived by his widow, and three brothers.

◆

Frank Reinick of Reinick & Krueger Co., 106 North Francis St., Madison, Wisconsin, died of heart failure on June 4. Reinick & Krueger had been partners for 21 years. The business will be continued by Mr. Krueger under the old firm name.

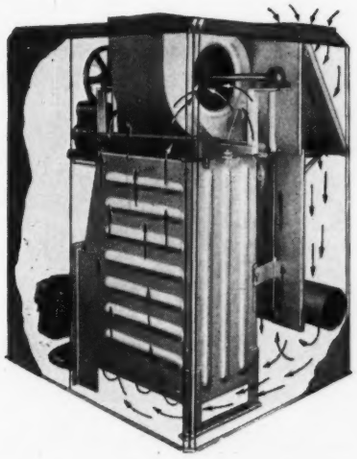
◆

Walter F. McCormick, 67, Albany, Ind., one of the four brothers who founded and operate the McCormick Brothers Sheet Metal Company, died May 24 following a heart attack. He is survived by his three brothers, two sons, one of whom is Myron McCormick, New York actor, and a daughter.

◆

Clarence Alfred Warfel, 48, owner and operator of the Warfel Sheet Metal Works at Muncie, Ind., died May 25 at his home following a heart attack. He had acquired a wide reputation in the building and construction field in central Indiana. He is survived by his widow, Kathleen, his mother, one son, a daughter and a granddaughter.

Large or Small— Dailaire Does the Job

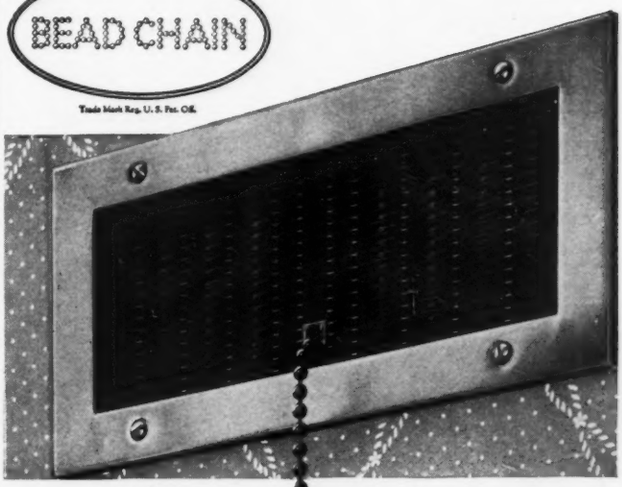


Dailaire has units designed to fill air-conditioning requirements of any size job from public building to small home. Advanced engineering features make Dailaire highly efficient, result in satisfactory performance. Units are favored for new buildings by architects because of accurate zone controlling. It's to your advantage to investigate the Dailaire line. Write today for full details of our dealership plan.

DAIL STEEL PRODUCTS COMPANY
1050 E. Main St. Lansing, Mich.

BEAD CHAIN

Trade Mark Reg. U. S. Pat. Off.



Courtesy Barber-Colman Co., grille manufacturers

BEAD CHAIN*

For controls and regulators, particularly where the pull comes over mouldings or around corners, BEAD CHAIN* not only reduces friction but adds distinctive beauty to the fixture. In bulk or assemblies, brass and nickel silver, with natural or chromium plate finish.

Our engineering department is available to assist in the design of assemblies for sheet metal use.

THE BEAD CHAIN MANUFACTURING CO.
*Reg. U. S. Pat. Off. 8 Mt. Grove St., Bridgeport, Conn.

How the CHAMBERLIN Automatic Humidifier

Gives You... *Dependable Service* • *Added Profits* • *Satisfied Customers*

YOU will get added profits by selling healthful, comfortable humidification at low cost to hundreds of home owners in your community. The Chamberlin is easy to install, fully automatic and fits any furnace hood.

The large water way through the patented integrally cast trap assures free flow without liming. A long float rod on the improved valve, which is entirely above the water line, gives positive water shut-off at any pressure. Cast entirely in one piece and finished in durable baked enamel. Vapor pan is 3" deep but carries only 1" of water to insure rapid evaporation.

Manufactured by a pioneer in this field, the Chamberlin combines dependability and attractive prices to make it a real business-getter for you. Thousands now in use. Write today for prices and free circular.

Manufactured by
CHANDLER COMPANY
Cedar Rapids, Iowa

PREMIER FURNACE CLEANERS
COMPLETELY EQUIPPED

HALF HORSE POWER MODELS
60.00 and 64.50
ONE HORSE POWER MODELS
84.50 and 89.50

Premier Furnace Cleaners are powerful and light weight, yet sturdily built to stand years of rugged service. Weighing less than 50 pounds, they are one-man cleaners and have been the furnace man's favorite for years. Premier Cleaners are ideal for upstairs use and may be used independently from the container for suction and blowing use in cleaning air ducts, registers, grills, radiators and air conditioning equipment.

Motor specifications for these powerful cleaners are:
½ H.P. maximum vacuum 31 inches in water.
1 H.P. maximum vacuum 46 inches in water.

Business-Getting, Return Post Cards are Available for Dealers at Low Cost

Buy It From Your Local Jobber or Write the Manufacturer

Furnace Cleaning Instruction Booklet Free with Each Cleaner

ELECTRIC VACUUM CLEANER CO., INC.
1734 Ivanhoe Road · Cleveland, Ohio

FOR ADDED YEARS OF SERVICE
USE *Randall* BEARINGS

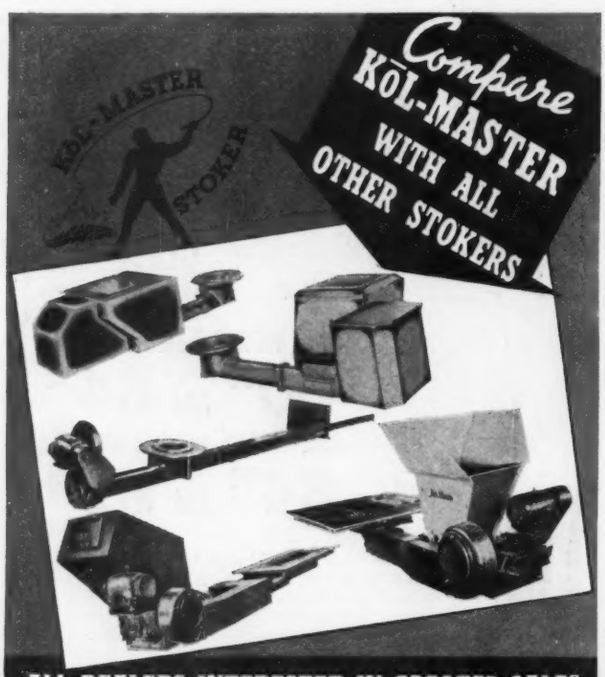
The proven ability of the Randall Standard Pillow Block to give long, trouble free service has made it the fastest selling bearing of its type in the industry.

This economical bearing is self-aligning, self-lubricating, quiet in operation and requires only a minimum of attention to last a lifetime.

Metallic bearing noise is entirely eliminated in blower systems equipped with Randall Bearings.

Write for new 1938 catalog describing in detail the complete line of Randall Pillow Blocks.

Randall GRAPHITE PRODUCTS CORP.
Dept. 711 609 W. Lake St., Chicago, Ill.



ALL DEALERS INTERESTED IN *GREATER* SALES AND PROFITS WILL DO WELL TO LOOK AT KOL-MASTER . . . THE LARGEST AND MOST COMPLETE LINE OF SINGLE RETORT, UNDERFEED, SCREWFEED STOKERS IN THE INDUSTRY! (More than 40 models ranging in capacity from 30 to 1600 lbs. per hour.) Write for Catalog 300.

★

KOL-MASTER CORP., OREGON, ILLINOIS

News Items . . . . . .

Palmer Has Repair Department

F. A. Palmer Sheet Metal Works, 1067 North St., Baton Rouge, La., furnishes a complete service in sheet metal work in the Louisiana capital city. It also has a department for repairs.

◆

Van Dorp Officials

Glenn H. Van Dorp was re-elected president of the Louis Van Dorp Sheet Metal & Roofing Co., which has been in business at Topeka, Kansas, for the past 55 years. Other officers are Fred Van Dorp, vice president and plant superintendent, and Hattie Patterson, secretary and treasurer.

◆

ERRATUM

In the May issue of AMERICAN ARTISAN—page 86—appeared the following news item:

"Walter Cook, 3410½ Parry street, Dallas, Tex., has sold out to the Dallas Sheet Metal Works, 3308 Swiss avenue, Dallas."

Mr. Cook writes: "There is no such firm operating in Dallas, Texas, as the Dallas Sheet Metal Works, and I have not considered selling my business to anyone."

WALTER COOK,
The Walter Cook Sheet Metal Works,
3308 Swiss Avenue,
Dallas, Texas

Check in at DeWITT OPERATED HOTELS

In CLEVELAND *it's* The HOLLENDEN

In COLUMBUS *it's* The NEIL HOUSE

In AKRON *it's* The MAYFLOWER

In TOLEDO *it's* The NEW SECOR

In JAMESTOWN (New York) *it's* The JAMESTOWN *and* The SAMUELS

and featuring

Unusually Comfortable, Modern Rooms; Good Food, Carefully Prepared and Served; Every Modern Hotel Facility and Reasonable and Uniform Rates

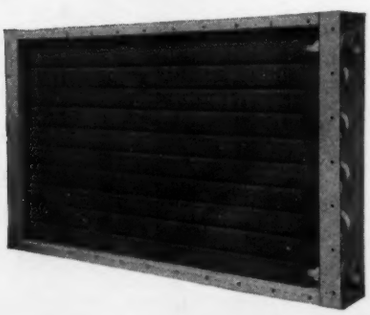
"Genuinely Friendly"

G&O RADIATION

FINNED COILS

G&O FINNED RADIATION COILS for all industrial applications are available in a wide range of sizes, for high and low pressure operation.

SEND FOR CATALOG



THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

PERFORATED METALS

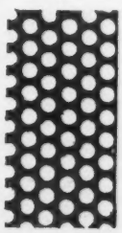
Every Sheet Metal Worker needs perforated metal in one form or another.

For processing food products and to withstand certain chemicals, perforated Stainless Steel and Monel Metal are much used.

Factory Safety Guards—For this service perforated metal has no equal.

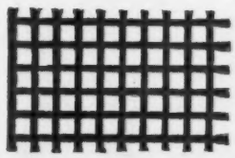
For Grilles, Radiator Enclosures, Air Conditioning Cabinets, we have many beautiful designs.

Write today for information and prices.



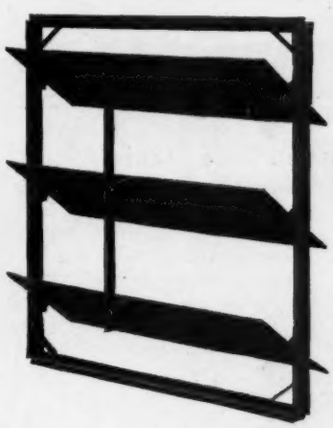
You'll like H&K prompt, satisfying work and pleasing prices.

Perforators of metals since 1883. Send us your specifications.



The Harrington & King PERFORATING CO.

5649 Fillmore St., Chicago, Ill. New York Office, 114 Liberty St.



AMERICAN LOUVRE DAMPERS

These louvre dampers may be had with either angle or channel frame and with ball or pin type bearings. Furnished to fit any size opening—and for either manual or motor operation.

Check list below for other reliable AMERICAN items to help add to your profits. Write us today for free literature.

OTHER AMERICAN PRODUCTS

WARM AIR VENTILATING GRILLES
MULTIPLE LOUVRE DAMPERS AND SCREENS
MIXING DAMPERS
FUSED LINK FIRE DAMPERS AND SCREENS
SINGLE LEAF VOLUME AND BY-PASS DAMPERS

THE AMERICAN WARMING & VENTILATING CO.

1017 Summit Street, Toledo, Ohio
663 Broadway, New York City

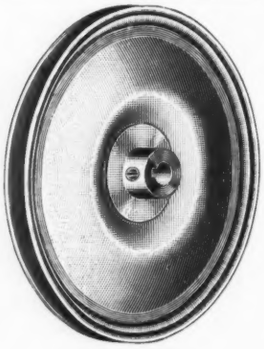
SERIES 300 FURBLO...

THE Series 300 Furblo adds to its other outstanding features SECTIONAL CONSTRUCTION, which permits easier installation, and allows access doors to be placed on any side. Quiet operation, high motor mounting and modern design also aid in making the Series 300 the blower "buy" of the year. Write NOW for literature.

Write NOW for further information.

FURBLO CO., Hermansville, Mich.

MAUREY
STEEL V-PULLEYS
Specially Designed for High Efficiency Operation with STOKERS, BLOWERS, FANS, REFRIGERATION, AIR CONDITIONING and Other Domestic Units



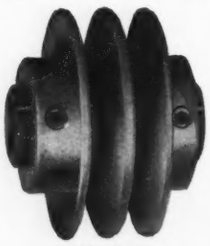
Balanced, true running and quiet at all speeds. Built to give long trouble-free service under severest use. Made with heavy rolled steel edges and SOLID STEEL or malleable iron hubs, machined. Carried in stock for "A" and "B" belts, in a wide variety of sizes. With DOUBLE GROOVE as well as single groove.

No Die Cast Hubs Used in MAUREY Pulleys.

MAUREY Variable Pitch Diameter Pulleys

Single Groove

Solid steel construction. Adjustment permits speed variation of as much as 30%. Designed for Air Conditioning Units. Solid steel — not die cast. Made in 4 sizes, 3¼" to 4½ inches in diameter.



Double Groove

MAUREY MANUFACTURING CORP.
Wabash at 29th Chicago, Ill.

Another MARLEY
"Small Series" Unit
ALL-STEEL INDUCED DRAFT
Made in Four Standard Sizes for Efficient INDOOR SERVICE
Companion to Marley "Small Series" outdoor tower, recently announced.
Wood filling . . . spray distribution . . . zig-zag drift eliminators . . . Multi-blade fans. Suitable for all refrigerating or air conditioning loads up to twelve tons capacity. Carried in stock for immediate shipment. Write for Bulletin No. 502.
THE MARLEY COMPANY
3001 Fairfax Road Kansas City, Kansas
MARLEY
WATER COOLING SYSTEMS

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 92.

239—Standardized Drives

Congress Tool and Die Company, 9030 Lumpkin Avenue, Detroit, is distributing a 4-page folder, covering Congress standardized drives, with list prices and engineering data.

240—Welders

Miller Electric Mfg. Co., Appleton, Wisconsin, is distributing a small envelope stuffer with space for dealer imprint entitled "Try Miller Welders." There is brief description with a list of models and sizes available.

241—Perpetual Spring

Royal Air Conditioning Equip. Co., Compton, California, is distributing a small envelope stuffer with space for dealer imprint entitled "Yours the Comfort of Perpetual Spring," describing their gas-fired Race winter air conditioner in a range of sizes from 90,000 to 225,000 Btu, complete with thermostat, fan limit control, motor, filters and blower. There is a time-payment plan.

242—Catalog No. 300

Kol-Master Corporation, Oregon, Illinois, manufacturers of Kol-Master stokers, announces publication of its new Catalog 300. The catalog is fully descriptive of all details of Kol-Master's patented and exclusive features of design, construction, and operation. It covers the entire line of Kol-Master domestic, commercial, institutional and industrial models—ranging from 30 lbs. to 1600 lbs. per hour.

243—Cooling Towers

The Marley Company, 3001 Fairfax Road, Kansas City, Kansas, offers their Bulletins 500 and 502, illustrating and describing their entire line of "Small Series" steel-cased induced draft cooling towers.

The two bulletins describe and illustrate 28 models with complete specifications and capacities. Bulletin 500 covers the vertical towers for outdoor service, available in either wood or spray filled types. Bulletin 502 deals with the horizontal towers, especially designed for indoors.

244—Armco Data Sheets

American Rolling Mill Company, Middletown, Ohio, is distributing Pencil Points Data Sheets prepared by Don Graf with useful information on Armco sheet metals for roofs, roof drainage and general architectural work.

Included with these is a roof leader selector and corrugated roofing slide rule showing purlin spacing (span in feet), safe load in pounds per square foot and gage of metal, punched for the same binder.

245—A New Monel

The International Nickel Company, Inc., 67 Wall St., New York City, tells about the new harder temper, mill-finished Monel sheet especially developed for the food service and hospital fields—No. 35 Monel—in a new booklet which describes the characteristics and contains numerous illustrations of typical installations.

246—Improves Welding Conditions

The Lincoln Electric Company, 12818 Coit Road, Cleveland, is distributing a folder illustrating and describing their "Linconditioner" entitled "Air Conditioning for Lower Welding Costs." The Linconditioner filters the smoke and removes the heat of welding operations, thereby contributing materially to the efficiency of workmen and the improvement of shop conditions generally.

247—Ventilattic

The Peerless Electric Company, Warren, Ohio, is distributing a 4-page folder describing and illustrating the "Ventilattic"—a new line of Peerless attic ventilators.

H&C DAMPER REGULATOR SETS

BRACKET TYPE

With ¼" Bearings as shown No. 50¼. ⅜" size No. 50⅜.

DISK TYPE

With ¼" Bearings as shown No. 80¼. ⅜" size No. 80⅜.

¼" sets have snap end bearings for easy installation of small dampers. All sets may be used with either splitter or regular dampers. All parts have rust-proof finish. Insure satisfactory installations by using H & C Damper Regulator Sets. All leading jobbers carry them.

HART & COOLEY MFG. CO., 61 W. KINZIE ST., CHICAGO, ILL.

WHITNEY LEVER PUNCHES

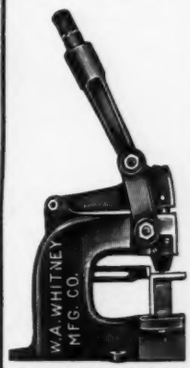
No. 4B PUNCH

Length—8½ inches. Capacity ¼-inch through 16 gauge. Deep Throat—2 inches. Weight—3 pounds. Punches and Dies—$\frac{1}{16}$" to $\frac{1}{4}$" by 64ths.

No. 6 PUNCH

Length—26½ inches. Capacity — ¼-inch hole through $\frac{1}{16}$-inch iron; especially adapted for button punching or templet work. Punches and dies ⅛" to $\frac{1}{4}$" by 32nds.

No. 91 PUNCH



Capacity — ⅝-inch hole through ¼-inch, 1-inch hole through $\frac{1}{16}$-inch and 2-inch hole through ⅛-inch iron. Depth throat 5 inches. Weight—82 lbs.

We have tools for every purpose needed by Sheet Metal Contractors.

Ask your Jobber

No. 1 PUNCH

Length — 34 inches. Capacity — ⅜-inch hole through ¼-inch iron. Punches and dies in sizes from ⅛ to $\frac{1}{16}$ by 64ths.

No. 2 PUNCH

Length — 23 inches. Capacity — $\frac{1}{16}$-inch hole through ¼-inch iron. Punches and dies in sizes $\frac{1}{16}$-inch to ½-inch by 64ths.

CHANNEL IRON PUNCH

Companion to No. 2 Punch. Every part of the two Punches Interchangeable, including punches and dies. Capacity—¼-inch hole through ¼-inch iron.

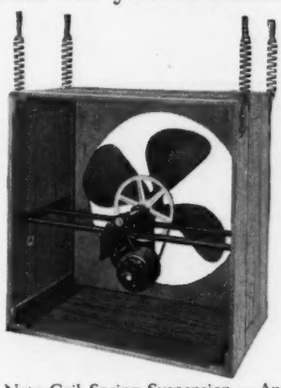
W. A. WHITNEY MFG. CO.
636 RACE ST. ROCKFORD, ILL.

Peerless

"Ventilattic" Fans

Will make good profits for you in Attic Ventilation.

Low in price—High in Quality. Include Thermal-Protected and Automatic Belt Tension Device.



Note Coil Spring Suspension — An Exclusive "Ventilattic" Feature

Peerless pays the Freight on Complete Units!

Write today for prices on "Ventilattic" Fans—Exhaust Fans, Blowers and Motors.

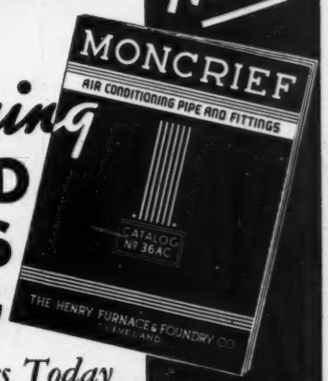
FAN & BLOWER DIVISION

FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC CO.
WARREN, OHIO

MONCRIEF Air Conditioning PIPE AND FITTINGS CATALOG

NEW



Send for Yours Today

You need this valuable data book in your air conditioning business. It will make estimating easier and help you lower the costs of the complete installation . . . and the Moncrief patented lock joints on wall stacks, stack heads, footpieces and trunk duct fittings make a more efficient, neater job that is easier to install.

NOW MORE COMPLETE THAN EVER

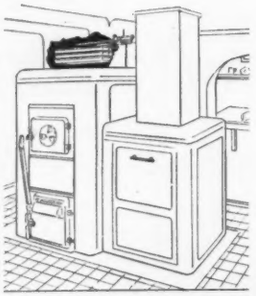
The Henry Furnace & Foundry Co.
3473 E. 49th St., Cleveland, Ohio

Write for this valuable book today

HOME OWNERS WANT THE HUMIDIFIER THAT CONTROLS EVAPORATION TOO

. . . *and* **THERMO-DRIP** *is it!*

The THERMO-DRIP vapor pan is shallow . . . broad . . . light gauge STAINLESS STEEL. Never contains more than a film of water. That's a matchless combination for fast evaporation. But you can offer prospects even more when you sell THERMO-DRIP. Bonnet heat measures the water fed to the pan—drop by drop. It's self-regulating! And evaporation is modulated by the rate of temperature-regulated water drip. Homeowners want—and can afford—these THERMO-DRIP advantages. Push them for profit.



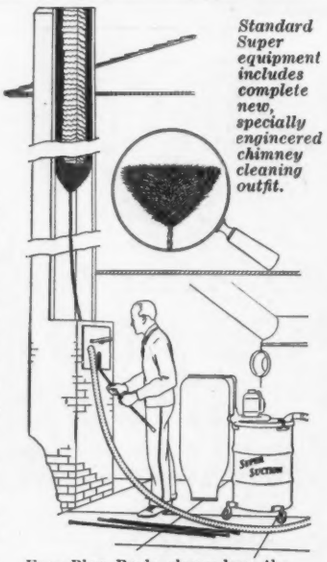
MULTIPLE PAN MODELS *are available for plenum chambers. Easy installation. Attention-free operation.*

AUTOMATIC HUMIDIFIER CO.

18th and Main Streets CEDAR FALLS, IOWA

What Is He Doing?

Believe it or not, he is selling a nice order of new parts and repairs for that heating plant—by cleaning a chimney with his new specialized Super chimney tools. They have opened this big, new—and splendidly profitable—field for service by heating plant men who find they make double profits on every Super-cleaned job. One on the cleaning—one on the new stuff needed. Easy to sell chimney cleaning. Make us tell you how.



Standard Super equipment includes complete new, specially engineered chimney cleaning outfit.

Free Plan Book, shows how the *girl* in your office will get enough new business to keep you busy all summer.

USE THIS COUPON

The National Super Service Company
1944 N. 13th Street, Toledo, Ohio

Send me the Plan Book and complete information about your free trial and the new low-priced Super.

Name .....

Street Address .....

City and State .....

New Literature . . . .

For your convenience in obtaining copies of new literature, use the coupon on this page.

248—Radolite and Heat-Aid

The Pyrolite Products Co., 1221 West 74th St., Cleveland, is distributing a circular on their Radolite refractory cements and another on their Heat-Aid, a plastic furnace lining which they say reduces fuel cost.

◆

249—Shears, Flangers and Slitters

Niagara Machine & Tool Works, 637 Northland Avenue, Buffalo, New York, is distributing Bulletin 70-D with complete up-to-date information on the Niagara line of power-operated circle shears, ring shears, flangers and slitters.

◆

250—Refractories for Stoker Settings

Refractory & Insulation Corporation, 381 Fourth Avenue, New York City, is distributing Bulletin S-1 covering their stoker Moldit cement, plastic fire brick, No. 3000 refractory cement, furnace cement and Stic-Tite insulating cement, for stoker settings.

◆

251—Capillary A. C. Units

Air & Refrigeration Corporation, 11 West 42nd St., New York City, is distributing a 24-page catalog describing the Capillary Conditioner and its application to air conditioning. The device may be used either as a humidifier or a dehumidifier in conjunction with assemblies of standard apparatus in any general type of air conditioning system. The Capillary cleans the air besides conditioning it.

◆

252—Arc Welding and How to Use It

Hobart Brothers Company, Troy, Ohio, has just brought out "Arc Welding and How to Use It" with new developments in arc welding, rods, machines, and technique. This 340-page manual with 320 illustrations is written in plain, understandable English and divided into six logically arranged sections. General information on the development of arc welding, weldability of metals, applications or uses, various types of joints and welds, welding rods, welding speeds and costs; a series of practical welding lessons; information on carbon arc welding and cutting plus instructions for welding of non-ferrous metals; special information particularly interesting to engineers, designers, supervisors, etc. with its discussion of standard steel shapes, welding symbols, sheet steel and wire gauges, physical properties of elements and metals, weights of alloys and other special data; modern welding equipment briefly described and discussed.

FOR YOUR CONVENIENCE

American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Circle numbers in which you are interested):

123	124	125	126	127	128	129
130	131	132	133	134	135	136
137	138	139	140	141	142	143
144	145	146	147	148	149	150
151	152					

239	240	241	242	243	244	245
246	247	248	249	250	251	252

Name..... Title.....

Company .....

Address .....

Are you Manufacturer——Jobber——Dealer——

JUST OFF THE PRESS

HAVE YOU RECEIVED YOUR COPY?

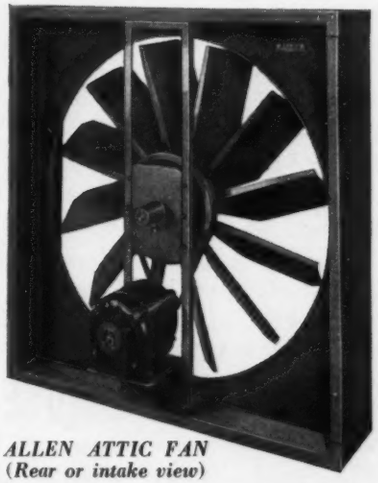
WRITE

The New Rock Island Register Catalogue Shows Complete Line of "No-Streak" Registers for Gravity and Forced Air Installations.

Also many helpful Charts, Tables, Estimating Data—Prices. A catalogue every Dealer should have. Send for your copy today.

ROCK ISLAND REGISTER CO.
ROCK ISLAND ILLINOIS

SILENT COOLING!



ALLEN ATTIC FAN
(Rear or intake view)

Profits for YOU this Summer

Allen Attic Fan (made by the makers of Allen Turbine Ventilators) gives Silent Exhaust, cools the house quickly by drawing off the hot air at the top. Correct installation gives one complete air change per minute throughout the entire house. Sell this equipment to hosts of home owners who can not consider expensive ventilation systems. The ideal Summer-Volume Booster. Moderately priced; sizes 24 to 60 inch; 1/4 to 1 H.P.; 4400 to 31,300 c.f.m.; dimensions 30" to 72" square. Complete specifications promptly on request.

The ALLEN Corporation
9752 ERWIN AVENUE DETROIT, MICHIGAN

SELL *Pacific*

AND PACIFIC QUALITY WILL KEEP YOUR CUSTOMERS SOLD

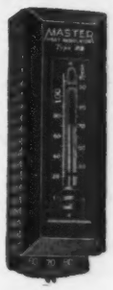
Write for details of the liberal Pacific Dealer Plan and illustrated descriptive literature showing the complete line of up-to-the-minute Pacific Gas Heating Appliances.

Pacific

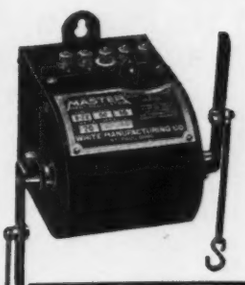
GAS RADIATOR CO.
1740 W. Washington Blvd., Los Angeles, Calif.
Manufacturers of the Most Complete Line of Gas Heating Appliances in the West

DEPENDABILITY

No Master product is ever made available until its accuracy and dependability have been completely proven. The model B-22 has proven its dependability not only in our exhaustive tests, but in use under actual operating conditions in the many years it has been sold and installed all over the country.



TYPE B-22



A two position heat regulator that is ideal for the small home. It is sturdily made and dependability and precision are built right into it. A noiseless device that will outlast the heating plant.

WHITE MFG. CO.
2362 University Ave.
St. Paul, Minn.

MASTER HEAT REGULATOR

Precalculated Engineering

(*Continued from page* 61)

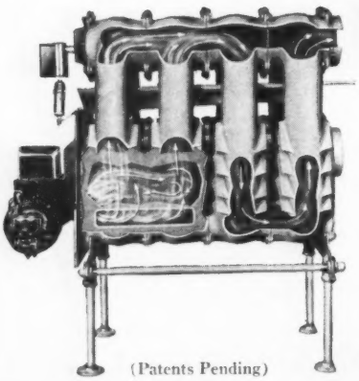
substituting in the formula:

Furn. No. 1, Btu. at registers 119,340×1.036=123,635
Furn. No. 2, Btu. at registers 119,340×1.0 =119,340
Furn. No. 3, Btu. at registers 119,340×0.928=110,747

Notice the significant fact that for each of these furnaces, if we divide the Btu. delivery at the registers for mechanical circulation, by the number of square inches of rated gravity leader area given in the previous gravity capacity tabulation, we get the same quotient, 197.

Furn. No. 1.....123,635 ÷ 628 = 197
Furn. No. 2.....119,340 ÷ 606 = 197
Furn. No. 3.....110,747 ÷ 562 = 197

This means that *for mechanical heating, the heat delivery at the registers in Btu. per hour, is equal to the gravity rating of the furnace of square inches of leader area multiplied by* 197. By use of this factor 197 any heating contractor can convert the rating of the furnaces he handles from gravity to mechanical heating capacity for the "standard" combustion rate of 7.5 pounds of coal per square foot of grate per hour.



(Patents Pending)

THE UNIQUE OIL BURNING AIR CONDITIONER

The most efficient heating unit on the market—due to

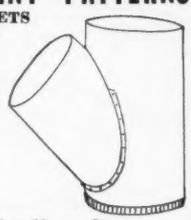
1. All-cast Heating Element, with greater heating surfaces, tighter joints, longer life and the heat-transfer rate of steel, producing practically perfect combustion and heating.
2. Design of Heating Element which effectively breaks up air currents to provide maximum heat pick-up and uniform air temperatures.
3. Directional Fins which divert cooler air to center of Heating Element so that air currents are thoroughly mixed.

Write today for our dealer proposition.

THE EXCELSIOR STEEL FURNACE COMPANY, 118 S. Clinton St., Chicago, Illinois

GRAY'S FULL SIZE BLUEPRINT PATTERNS

45 DEGREE BRANCH PATTERNS IN 2 SETS



SET No. 3—2 in. to 12 in. branches on 2 in. to 30 in. diameter.....$5.00
SET NO. 4—12 in. to 24 in. branches on 12 in. to 48 in. diameter..... 5.00
385 patterns in the two sets.

ELBOW PATTERNS.
SET No. 1—1 in. to 20 in. 2-3-4-5-6-7 piece, including Tee patterns 2 in. to 20 in. diameter. 152 patterns $2.50.
SET No. 2—20 in. to 40 in. 5-6-7-8-9 piece and angle chart showing what pattern and number of pieces to get required angle. 105 patterns $2.00.
SKYLIGHTS.
Hip, gable and single pitch, putty bar • Hip, gable and single pitch, puttyless, with square ridge vent and base patterns. $5.00 each.
Turret lights to operate by gearing. $3.00. Louvres—stationary and to operate. $3.00. Roof ventilators and base patterns. $5.00. Ship ventilators—6 piece 4 in. to 24 in. at base.
Patterns sent postpaid upon receipt of P. O. order or check.
G. L. GRAY, 507-511 Grand Avenue, NEW HAVEN, CONN.
Write for pattern circular giving full information.
Mention American Artisan

INCREASE PROFITS *with*
THE GRAND RAPIDS FURNACE CLEANER

Powerful—One-Man Portable Sturdy

The first Grand Rapids Furnace Cleaners put out years ago are still in use. Dealers say they are the best with no wear out to them.

Free Trial—Convenient Terms
Write for Details

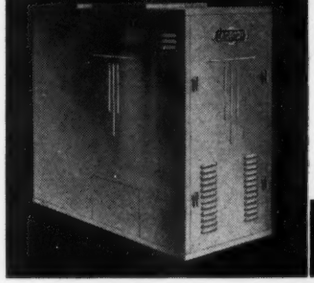
GRAND RAPIDS FURNACE CLEANER CO. 225 STEVENS ST., S. W. GRAND RAPIDS, MICHIGAN

JOHNSON No. 502 SOLDERING FURNACE CUTS YOUR COSTS

Save money and do many jobs better with this powerful double-jet soldering furnace. Because of two patented Direct Jet Burners you get intense heat without blower or forced air draft. Designed to heat soldering coppers up to 12 lbs. per pair, heat treat small metal parts such as gears and tools, and to melt soft metals. Firebox has a fire brick base lining. Curved return-blast hood is hinged and removable. For details of the complete line of efficient JOHNSON Industrial Gas Appliances, write today for free catalog.

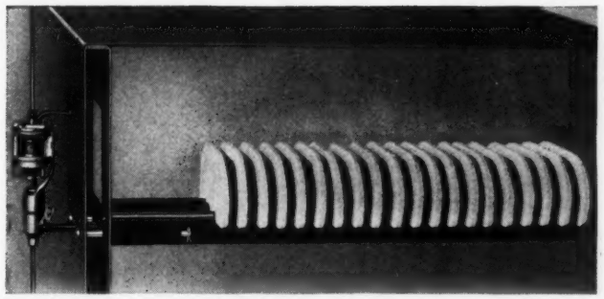
JOHNSON GAS APPLIANCE CO. Cedar Rapids IOWA

CENTURY



ZEPH-O-LATOR
85%
OVERALL EFFICIENCY

CENTURY ENGINEERING CORP.
CEDAR RAPIDS IOWA

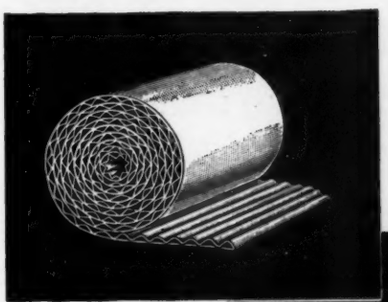


AUTOMATIC JUNE
HYDRO-METRIC HUMIDIFYING SYSTEMS

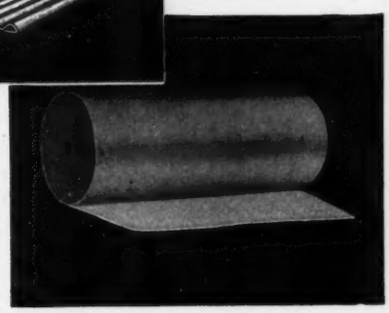
Always enough—never too much humidification—controlled and graduated in accordance with outside temperatures—these are the unique and unexcelled benefits afforded by Automatic June Hydro-Metric Humidifying Systems. Complete systems, simple, trouble-proof and easy to install. Send for literature and prices.

MONMOUTH PRODUCTS CO.
1933 E. 61st St., Cleveland, Ohio

SAL-MO Asbestos Insulation
Curbs HEAT LOSS in Warm Air Furnace Installations . . . Assures More Efficient Operation.



(Left) SAL-MO Asbestos Aircell Paper



SAL-MO Asbestos Paper and Rollboard

BE sure that your Warm Air Furnace installations do not have that 30% heat loss that is usual with uninsulated pipes. When you use SAL-MO Asbestos Papers and Millboards you are sure of a perfect job and perfect insulation. SAL-MO Asbestos Products are of uniform high quality, manufactured from the best grade of Canadian asbestos fibre.

Other SAL-MO Products include Pipe Joint Tape, Furnace Cement, Fireboard and coverings for all types of High and Low Pressure Pipe Lines.

SALL MOUNTAIN COMPANY
176 West Adams St. CHICAGO, ILL.

You Can RELY On This "NEW TYPE OF CRAFTSMAN"

TO REDUCE YOUR SERVICE AND INSTALLATION COSTS . . .

Quality equipment properly installed and correctly serviced is a winning combination you can always depend on to bring that satisfied customer's recommendation so valuable to every business. You've *always* been able to control the quality of your equipment; and NOW *you can control the quality* of your installation and service work.

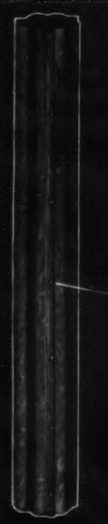
More than 100 leading manufacturers are officially endorsing and recommending the Training Program being conducted by the Refrigeration & Air Conditioning Institute under the direction and supervision of factory engineers, working right in the industry, so as to provide you with a source of dependable, highly skilled refrigeration and air conditioning service engineers. This *New Type* of *Craftsman*, created especially for the Refrigeration and Air Conditioning Industry is, in a way, a composite of all the crafts employed in air conditioning work insofar as they are used in Air Conditioning installations. He can help you increase your net profits in three ways:—first, Eliminates the need for costly training; second, Reduce your service expense; third, Helps to develop new business through satisfied customers. He is then, a man who can become a definite asset to your business from the first day his name is added to your payroll.

The individual qualifications of each man trained by the Refrigeration & Air Conditioning Institute is recorded in a form which enables you to select, at a glance, the man best suited to your needs. . . . Mr. Employer, will you let us shoulder your *Training Costs* and help you solve your man-power problem?

MORE THAN 100 LEADING MANUFACTURERS "OFFICIALLY" ENDORSE AND RECOMMEND THIS TRAINING PROGRAM

Ray A. Smith
PRESIDENT

REFRIGERATION & AIR CONDITIONING INSTITUTE
Division of the Industrial Training Corporation
2130-2158 Lawrence Avenue • CHICAGO, ILLINOIS



"BB"
The Mark of Quality

Seam Locked Every Few Inches

"Shur-Lock" Pipe

BERGER BROTHERS CO.
229-237 Arch Street, Philadelphia, Pa.

EAVES TROUGH
GUTTER HANGERS
CONDUCTOR FASTENERS
MITRES
END PIECES AND CAPS
CONDUCTOR HEADS
ORNAMENTAL STRAPS
VENTILATORS, ETC.

Write for catalog of the "BB" Line
Buy from your jobber

Can be suspended from ceiling as shown, or floor mounted. Few if any building alterations required in order to install.

Ideal for Stores, Cafes, Theatres, Offices, etc.

Last word in low-cost air conditioning. Easy to sell —and they stay sold because of guaranteed performance. Backed by 25 years' experience. Wide range of combinations—a unit of proper size and capacity for practically any cooling, heating or complete conditioning need. Quiet in operation.

SPECIFY CLARAGE for COMPLETE AIR CONDITIONING, VENTILATION, HEATING, COOLING, MECHANICAL DRAFT, FANS & BLOWERS FOR INDUSTRIAL NEEDS

Sizes up to 15,000 CFM. *Write for Bulletin 107.*

CLARAGE FAN COMPANY • Kalamazoo, Mich.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

ANTHRACITE INDUSTRIES approved INCORPORATED

PROVED and APPROVED —G-A— Temperature Controls

More Sensitive . . . More Reliable . . . More Satisfactory

G-A Temperature Controls are APPROVED by Anthracite Industries Laboratories and the Underwriters' Laboratories. They've been PROVED by years of hard usage in thousands of installations. Contractors and heating engineers recommend them for trouble-free performance. And approved by dealers everywhere—not only for their high quality and lasting satisfaction—but because *they offer both dealer and jobber a wider margin of profit* on every installation. Check the complete G-A line including—**Thermostats, Damper Control Motors, Limit Switches, Relays, Time Switches, Stoker Controls, etc.**

For your own—and your customer's—complete satisfaction, specify G-A's on EVERY job. See your jobber or write today for complete catalog and price list.

GLEASON-AVERY, INC.
24 Clark St. Auburn, N. Y.

Pennsylvania Convention

(*Continued from page* 68)

son's oft repeated quotation to the effect that "Fighting over what now exists, instead of trying to produce more, is our first big mistake. Trying to revive old industries is a second big mistake. Air conditioning offers the greatest opportunity at present. It directly or indirectly can give millions of people jobs and go a long way toward restoring employment to normal conditions."

There is great need for this industry to do a job of selling. We must sell builders on the merits of our service and our materials, on our knowledge of requirements for sheet metal and heating and upon our reliability and responsibility, said Mr. Markle.

"Much sheet metal repair work should be done, but first, we must unsell the buying public on the advantages of employing the handyman to do such work. It has come to my attention that wood hanging gutters have been introduced in some areas; that mail order competition is making a leader of undersized furnaces; in many parts of the country there is a growing practice of employing maintenance crews for public buildings to make work for friends of politicians; all kinds of work is now being done by WPA and PWA, which work should go to the legitimate contractor; the only way to meet competition of other businesses or unfair practices is to outsell the unfair bidder. The only other remedy for these practices which I can suggest is the formation of a strong state sheet metal association, which association, through committees, should be able to find satisfactory ways and means of combatting unfair practices."

The Cost of Doing Business

R. S. Hahn, speaking on the subject "Overhead and The Cost of Doing Business," referred to figures presented by Fred Ritter, formerly secretary of the Philadelphia association at the 1938 meeting of New York sheet metal contractors. These figures of Mr. Ritter, according to Mr. Hahn, and as reported in the May, 1938, issue of American Artisan, showed the average overhead for Philadelphia shops as 104% of productive payroll. As pointed out by Mr. Ritter, the chief items of overhead expense were productive labor 57%, auto and truck expense 13%, rent 8%, sales adjustment 8%.

Mr. Hahn declared that this overhead expense on productive labor was just a little higher than his own shop record, and went on to say that in the lean years of 1932, 33 and 34, the percentage on productive payrolls ran as high as 236%. Records of the Pennsylvania association for 1929, according to Mr. Hahn, showed that the overhead percentage was less for large shops than for small shops, with businesses having a gross volume below $50,000 showing 103% overhead on productive payroll, and

Repair Parts
GUARANTEED TO FIT

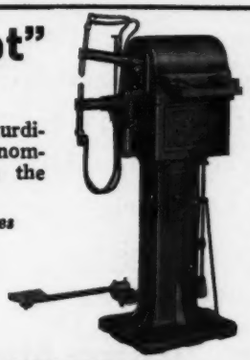
BRAUER
REPAIR PARTS
STOVE FURNACE BOILER OIL STOVE RANGE

GET IT ALL FROM US
AND SAVE
TIME AND MONEY

A. G. BRAUER SUPPLY CO.
316 North Third St. • St. Louis, Mo.

KEEP OLD MAN WINTER ON THE RUN
XX TH CENTURY HEATING & VENTILATING CO.
AKRON, OHIO

ACME "Hot Spot" WELDERS



Universally accepted as the sturdiest, easiest handled, most economical electric Spot Welder on the market.

Write for literature and prices

Don't Rivet
SPOTWELD!
with an ACME
Lifetime Guarantee!

Complete range of sizes

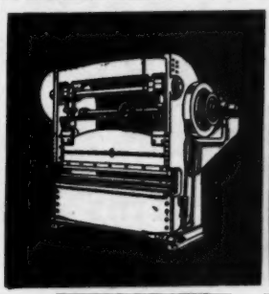
ACME ELECTRIC WELDER CO.
Distributors in principal cities
5619 Pacific Blvd. Huntington Park, Calif. (Los Angeles County)

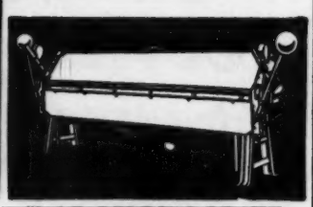
CONGRESS PULLEYS

Congress Pulleys are ideal for installation on stokers and blowers. They perform for years without service and insure the contractor against repeated call-backs due to pulley failure. Write today for literature. The line is complete and priced right.

Congress Tool & Die Company
9034 Lumpkin Avenue Detroit, Michigan

CHICAGO

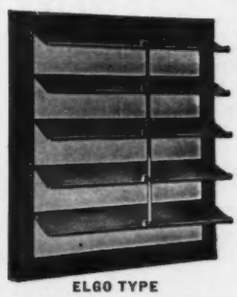




PRESS BRAKE HAND BENDING BRAKE

Steel Brakes—Presses—Shears

DREIS & KRUMP MFG. CO.
7404 LOOMIS BLVD. CHICAGO



ELGO TYPE

Get our prices on your requirements in Automatic Shutters, Stationary Shutters, Hand Operated Shutters, Balanced and Back Draft Dampers.

Elgo Ventilating Specialties

Sensational Automatic Shutter

Tightest fitting shutter on the market. Employs new method of weatherstripping which makes shutters open more easily and fit more snugly. New type swivel joint—good for the life of the shutter. No wear or rattle.

Write for circular and prices.

ELGO SHUTTER & MANUFACTURING CO.
634 W. Warren Detroit, Mich.

Free CATALOG

PORTABLE SHEARS
ALL-ALLOY

ALL-ALLOY No. 2 cuts up to ¼" steel plate.
ALL-ALLOY No. 1 cuts up to No. 11 gauge strip or sheet.
Special blades may be had for shearing stainless steel.

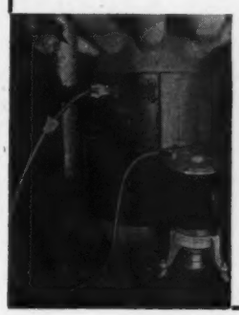
FULLY GUARANTEED

BREMIL MFG. CO. Erie, Pa.

HOW TO BOOST YOUR PROFITS

We can show you the easy way to:

MAKE MORE SALES
INCREASE YOUR EARNINGS



Yes, it can be done in mid-summer —if you have the right furnace cleaner. Write TODAY for full details of the Kent Double Suction. It's a real money-maker.

THE KENT COMPANY, Inc.
25 YEARS

167 Canal St., Rome, N. Y.

shops over $50,000 gross volume showing 73% on productive payroll.

Workmen's Compensation

Walter Keist read a paper on the workmen's compensation rate structure prepared from correspondence with the compensation board in Harrisburg. Mr. Keist's correspondence showed that the premium income is far above the payments made, indicating that the premium rate structure could be changed downwards. In the discussion, it was shown that several members attending had paid premiums as high as 300 percent above any claims paid.

Sales Methods

Harry E. Kottcamp of York, speaking on the subject of selling, pointed out the necessity for proper study of the lines and services the industry has to sell, and the need for understanding the merchandising phases of the business.

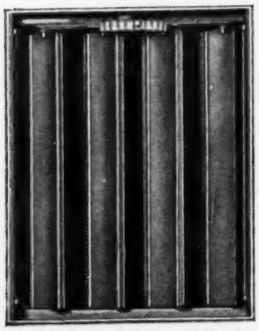
Responsibilities of the Jobber

Warren Carter of the Carter-Dunlevy Company, Philadelphia, outlined some of the responsibilities of the distributor to the sheet metal contractor.

Salesmen calling on Pennsylvania contractors formed a salesman's auxiliary and promised co-operation and support for all activities of the organization.

THE FIRST STEP

In real Register improvement is the new "Air-Con" Register. Cut at right shows the multiple shutters of the Register Bottom. Shutters have a throw of 135°, can be made to throw either right and left (or up and down).



ANY TYPE REGISTER FACE CAN BE APPLIED

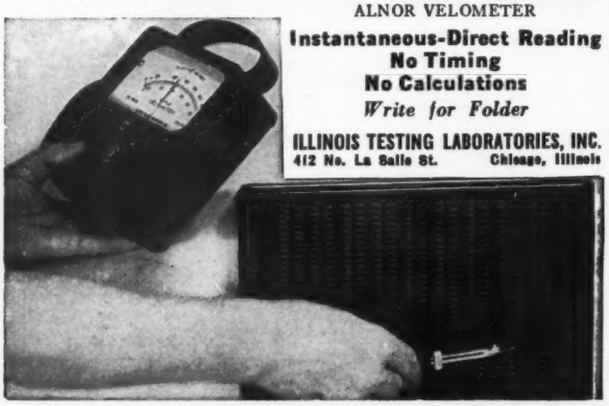
WATCH for the second development step of this wonderful Register!

REGISTER & GRILLE MFG. COMPANY, Inc., 70 Berry Street, Brooklyn, N. Y.

James H. Bailey, President
Trowbridge Warner, Sales Manager
Russell T. Bailey, Director
Bruce R. Tuttle, Gen'l Counsel
Clifford D. Bailey, Secretary
Edward F. Blom, Director
Frank T. Bailey, Vice President
Alfred L. Tuttle, Treasurer
Eric D. Mollander, Director

THE ALL PURPOSE AIR VELOCITY METER

ALNOR VELOMETER



Instantaneous-Direct Reading
No Timing
No Calculations
Write for Folder

ILLINOIS TESTING LABORATORIES, INC.
412 No. La Salle St. Chicago, Illinois

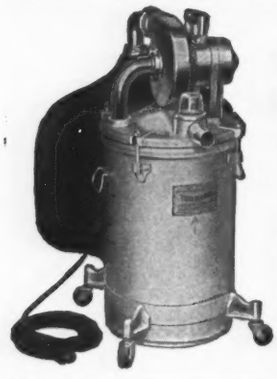
FURNACE • STOVE and BOILER REPAIR PARTS

Over 15,000 Patterns

We Sell Jobbers and Distributors Only

HOMER FURNACE & FOUNDRY CORP.
COLDWATER - - MICHIGAN, U. S. A.

How to Sell Furnaces and Repairs
WITH
The TORNADO Furnace Cleaner

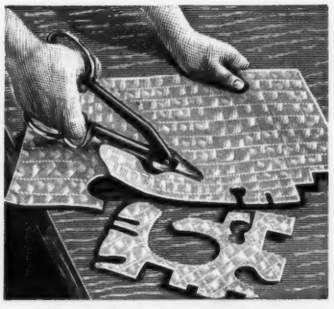


The TORNADO gets you into the basement where it is easy to sell repairs and new furnaces. And you make a profit on the cleaning job too!

Dealers say that the TORNADO is the most powerful furnace cleaner built. Leads the field! Low price—easy payments—free trial. Approved by Anthracite Institute and Underwriters Lab. Thousands in use.

Write now for complete information.

Breuer Electric Mfg. Co.
5082 Ravenswood Avenue, Chicago, Ill.



WISS
SCROLL-PIVOTER SNIP

Cuts circles, scrolls and squares as easily as a straight line. Will cut alloy metals.

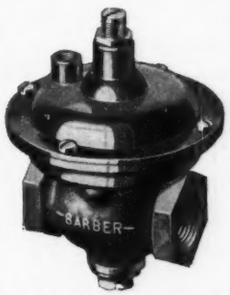
Now furnished with serrated blade unless otherwise ordered.

Use Wiss Hy-power and Bulldog Snips

J. WISS & SONS CO.
Established 1848 Newark, N. J.

Barber GAS Pressure Regulators

Barber Regulators have everything that a Quality Regulator must have—compact, attractive appearance in keeping with the modern trend in heating equipment design—high precision standards of manufacture—operate at very low pressure drop. All bronze body, brass working parts. Sizes ¼" to 1½", A. G. A. approved. Write today for catalog and prices on the complete line of Barber Conversion Burners and Regulators.



Made in ¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2" sizes.

The Barber Gas Burner Co.
3702-4 Superior Avenue
CLEVELAND . . . . . OHIO

NuDRY FURNACE CEMENT
"BEST BY TEST"

- Use Nu-Dry and have a gasket that will allow for expansion and contraction of the castings without cracking.

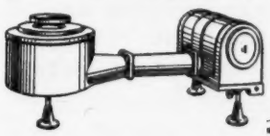
★ Will not crack, bloat or powder when furnace is fired immediately after applied.
★ Withstands high temperatures.
★ Keeps joints tight at all times.
★ Takes less material to set a furnace.

Send for free 5½ lb. sample.

PYROLITE PRODUCTS COMPANY
1221-31 West 74th Street
Cleveland, Ohio

PAR OIL BURNERS

The PAR Oil Burner is ideal for any installation. Simple in construction and operation, it has only one moving part, a 1/100 h. p. motor and fan. The Par requires no precast or brick combustion chamber, has no nozzles to leak or clog and is fully enclosed to guard against damage and prevent tampering. PAR burners protect the dealer with a five year restoration bond and an air-tight guarantee. Write us today for more information. A postcard is sufficient.



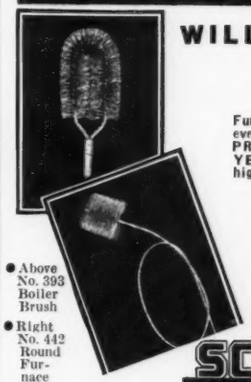
PAR APPLIANCES, INC.
La Crosse ● Wisc.

GET THIS CATALOG

With the COMPLETE U. S. AIRCO line you can meet any demand in year 'round air conditioning for stores, shops, cafes, offices and homes. Line up for YOUR share of the profits. Hurry—write today!

U. S. AIR CONDITIONING CORP.
2105 Kennedy St., N. E., Minneapolis, Minn.
420 Lexington Ave., New York
550 W. Washington Blvd., Chicago

FUEL SAVING and BETTER HEAT WILL *Sell* THESE BRUSHES



● Above No. 393 Boiler Brush
● Right No. 442 Round Furnace Brush

Furnace and Boiler cleaning is an important factor in every home heating plant. The new Schaefer RUSTPROOF FLUE AND FURNACE BRUSHES offer YEARS of efficient service at a price only slightly higher than the cheap profitless brushes you have been selling. Fast-cleaning wire bristles are made of a special Silvery Brite special alloy steel, thoroughly RUSTPROOF, not merely treated with rustproofing solution. Here's Quality that will sell—at a margin of profit worthwhile to you. Let us tell you of the aggressive Merchandising Plan behind Schaefer Rustproof Flue and Furnace Brushes.

SCHAEFER BRUSH MFG. CO.
117 West Walker St., Milwaukee, Wis.

SCHAEFER BRUSHES
BUY SCHAEFER-IT'S SAFER

MARSHALLTOWN

BUILT FOR PRODUCTION ★

No. 0 BENCH PRESS
★ OPEN BACK ★ INCLINABLE! ★

This precision built Bench Press has improved ball and socket connection—heavier construction—more die space and easier adjustment. Convertible clutch for single stroke or continuous operation. Write today for literature and prices.

MARSHALLTOWN MFG. COMPANY
920 East Nevada Street
MARSHALLTOWN, IOWA

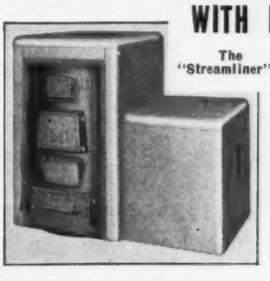
FORTIFIED

The semi-precious elements which have been scientifically combined to produce genuine Lyonore Metal present a united front against the destructive forces of time and weather. To assure lasting satisfaction, specify and use genuine Lyonore Metal for all sheet metal requirements!

LYON, CONKLIN & CO. Inc.
Baltimore, Maryland

Lyonore Metal
CHROMIUM — NICKEL — COPPER — IRON ALLOY

LOW COST CAST IRON FURNACE WITH FILTERS AND BLOWER



The "Streamliner"

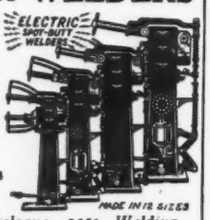
Is business hard to get? Then here's your salvation! A "Knock-out" for Beauty, Service and Price. Complete Winter Air-Conditioner, using famous 20-year guaranteed Peerless Cast Iron furnace. Streamlined to meet modern demand. Never a bargain like this before. Ask for literature and prices and make some real money before the snow flies!

PEERLESS FOUNDRY CO., 1853 Ludlow, Indianapolis, Ind.

AMERICAN ARTISAN Service Section

Weld With **EISLER WELDERS**

SPOT WELDERS
BUTT ● WIRE SEAM
A. C. ARC WELDERS



Welders as low as **$25.00**

Ask for 38-W Catalogue—1250 Welding Illustrations.

Submit Samples for Test. No Obligation

EISLER ENGINEERING CO., Inc.
761 S. 13th St. NEWARK, N. J.

RIBBED WIRE GLASS-13c per SQ. FT.
STOCK SHEETS, CASE LOTS, PLUS BOXING F. O. B. BUFFALO, N. Y. SHIPMENT TO ANY PART OF THE UNITED STATES
QUOTATIONS ON ALL KINDS OF GLASS ON REQUEST
Write for Samples
T. J. ATCHESON GLASS CO.
953 Main St., Dept. A, Buffalo, N. Y.

AUTOMATIC CONTROL
Repair Service
Thermostats, Relays, Starters and other automatic devices. All makes. Any type.
HALECTRIC LABORATORY
1793 Lakeview Road Cleveland, Ohio

JOHNSON'S
NEW HANDY MANUAL
on
HEATING, VENTILATING
MECHANICAL REFRIGERATION
and
AIR CONDITIONING

432 pages of practical, condensed information, tables, rules and diagrams. Price $1.00—Remit with order to

KEENEY PUBLISHING COMPANY
6 N. Michigan Ave., Chicago, Ill.

The American Artisan Service Section presents a golden opportunity to contact a national circulation at comparatively small cost. Manufacturers can use it to make any article sell and dealers will find it an inexpensive way to contact a live buying trade. Don't delay—send in your copy now for the next issue. See bottom of page for rates.

BEVERLY THROATLESS SHEARS
are indispensable to the modern, up to date sheet metal shop. Light, portable, yet extremely strong, they will make your shearing operations much faster, neater and more economical thru time saved on the job. They are made in two sizes to handle up to 14 or 16 gauge metal and are very reasonably priced.

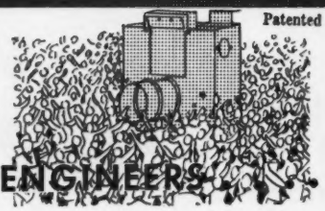
Write today for literature and prices.
BEVERLY THROATLESS SHEAR CO.
3009 W. 110TH PLACE, DEPT. 3, CHICAGO

JUST PUBLISHED!
The New, Enlarged 2nd Edition of Platte Overton's
"Forced Air Heating"
215 pages—Cloth Bound—$2.00

This new edition provides all the information needed by the contractor to enable him to design and install any forced air heating system correctly. It includes a brand new data sheet and shows how to fill it in. It outlines step by step a design procedure which may be applied to any job, and contains all the charts, tables, diagrams and formulas necessary. Send $2 for your copy today.

KEENEY PUBLISHING CO.
6 N. Michigan Ave., Chicago, Ill.

Patented



engineers everywhere are proclaiming the efficiency of the New *Howle Heat Extractor*. It extracts heat; it radiates heat; it stores excessive condensate and prevents escape of costly preheated air; it raises basement temperatures 10° to 20° F. So efficient is the *Howle Heat Extractor* that you cannot touch its front surface but you can lay your cheek against its rear.

CONDENSATION ENGINEERING CORPORATION
335 S. Western Ave., Chicago, Illinois

YOU
Can double the usual savings.
WE
would be pleased to mail you our latest stock list covering everything in metal working machinery — listing many real bargains in our huge stock of more than 2000 machines of all makes, models, types and sizes.

INTERSTATE MACHINERY CO., INC.
107 S. Clinton St., Chicago
(Free Parking)

LANCOL
SOLDERING FLUX

1. Lancol gives off no injurious fumes.
2. Lancol is odorless and causes no discomfort when used.
3. Lancol does not have the strong corrosive action of most fluxes.
4. Lancol is efficient—it causes solder to flow easily with no rolling up, and provides even coverage.
5. Lancol is efficient—it forms a perfect bond.
6. Lancol is more economical — it costs less.

Lancol is ideal as a stainless steel soldering flux—saves time, money and material. One test will convince you that you can't afford to be without a supply in your shop. Write us now for a free trial sample.

F. H. LANGSENKAMP COMPANY
Indianapolis, Indiana
Send for Trial Sample . . . Today!

G. A. VOORHEES
CONSULTING ENGINEER
FORCED AIR HEATING AND WINTER AIR CONDITIONING
633 S. Delaware St. Indianapolis

"AIR CONDITIONING FOR COMFORT"
NOW ONLY $1.00!

A new edition of "Air Conditioning for Comfort" will be published late this year. The few remaining copies of the present edition, priced until now at $2.50, are offered at only $1.00 each to those who may want one. This 277-page book, by S. R. Lewis, exhaustively covers the fundamentals of air conditioning, and explains, step-by-step, the planning of air conditioning systems for both residences and large buildings. To obtain a copy send $1.00 today to the address below.

KEENEY PUBLISHING COMPANY
6 N. Michigan Ave., Chicago, Ill.

SERVICE SECTION: Rates for display space similar to above in Service Section are $5.00 per inch per insertion. One-inch minimum space accepted. **Classified Section:** Rates for classified advertising are 5 cents for each word including heading and address. Count seven words for keyed address. Minimum $1.00 for each insertion. Cash must accompany order.

Classified

SITUATIONS WANTED

SHEET METAL AND FURNACE MAN. 10 years experience. 35 years old. Can lay out own work. State wages and house. Address Sidney McDonald, Attica, Ind.

MISCELLANEOUS

REAL SALES OPPORTUNITY. For a firm or man calling on builders to make a direct factory connection on a fast selling warm air conditioning line. Two models, one for speculative builders; one, the finest yet developed; both priced so nice profit can be realized. Address Key No. 436, American Artisan, 6 No. Michigan Ave., Chicago, Ill.

FOR SALE

FOR SALE: Complete Retinning Equipment with Electric Roller—Cheap. Address Raznick Sheet Metal Works, 2007 Cuming St., Omaha, Nebraska.

FOR SALE: Establisned Sheet Metal Business, Tulsa Sheet Metal Co., 13 & 15 South Lansing, Tulsa, Okla.

SITUATIONS OPEN

HEATING SALESMEN WANTED — We have openings for five thoroughly experienced heating salesmen. Do not apply unless your experience covers calculating heat losses, laying out forced air heating systems, servicing coal, oil and gas fired units. Address The Rudy Furnace Company, Dowagiac, Mich.

WANTED—Sheet Metal Workers, capable of doing general sheet metal work. State experience. Address Key No. 437, American Artisan, 6 No. Michigan Ave., Chicago, Ill.

Manufacturers Agents

MANUFACTURERS WANTING ADditional representation often come to us for names of prospective agents now handling other lines in this field on a commission basis in a definite territory. It will pay you to be on record with us so we can refer your name to interested manufacturers. No charge or obligation, of course. It is a service we render free to manufacturers and representative. Just drop a line that you are interested in being on file and we will send you form to fill out. Address American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Use AMERICAN ARTISAN Classified Advertising for quick results. It puts you in direct touch with the buyers and sellers in the warm air heating, sheet metal contracting and air conditioning industry.

AMERICAN ARTISAN Service Section

SHEET METAL MACHINES

● *Announcing*

4 NEW

MAPLEWOOD MACHINES

1. Model "E" 2 in 1 Rolling Machine. Forms Pittsburgh Lock and Drive Cleat (in 1 operation).
2. Model "D" 10 in 1 Combination A Machine for
   Slitting, Wiring, Turning, Burring, Cutting & Edging (1 operation), Making Elbows (2 operations), Single Beading, O. G. Beading, Crimping, Edge Straightening
3. Ingels Gap Gang Punch 10 holes with 1 stroke
4. High Speed—Specially Built Pipe & Lock—Rolling Machines for volume Production.

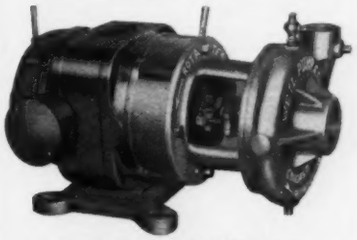
For full particulars and prices WRITE ON YOUR LETTERHEAD

MAPLEWOOD MACHINERY COMPANY, INC.
2634 Fullerton Ave., Chicago, Ill.

Let Books Help You Build Your Business

Whatever problems you may run into in gravity or forced warm air heating, air conditioning, sheet metal, or ventilating work, you can depend on finding information to help you solve them speedily and correctly in one or another of the many books that are now available for contractor-dealers in this field. Often a single idea or bit of data brought to you in a book repays the book's cost dozens of times over. Increase your knowledge and your capacity to earn by building up your business library. Write today to the Keeney Publishing Company, 6 N. Michigan Avenue, Chicago, Ill., for complete catalog of books on warm air heating, air conditioning, and sheet metal subjects.

AIR WASHER PUMP



Ask For Bulletin R-5500 Electropump
WEIL PUMP COMPANY
Wells and Superior Sts. CHICAGO, ILL.

"DO-ALL" Combination Electric Hammer & Drill

drills both concrete and metal. Cap. 1¼" in concrete—⅝" in metal. Saves time and money in setting expansion bolts, anchors and plugs. Soon pays for itself. Easy to maintain. Bulletin 371. Wedask Electric Tool Corporation, 4644 W. Huron St., Chicago, Ill.

SHAMBLEN SERVICE

is known throughout the trade. Your order filled when and how you want it and with parts that are guaranteed to fit.

Try us with your next repair job. Our service and repair parts cannot be excelled. No order too large, none too small. Write today for catalog and further particulars.

SHAMBLEN FURNACE PARTS COMPANY
231-39 First Avenue Pittsburgh, Pa.

CUT YOUR COSTS by Spot Welding

WITH **ACE** SPOT WELDERS

Cheaper, better and faster than riveting.

Built for production service. Engineered to meet practical requirements of sheet metal shops. Made in sizes from 5 K. W. up.

Only **$90**

for Series 62.
Welds 2 pcs. 16 Ga. Steel.
Send for free literature.

PIER EQUIPMENT MFG. CO.
Welding Equipment Division
720 Cross St., Benton Harbor, Michigan

SERVICE SECTION: Rates for display space similar to above in Service Section are $5.00 per inch per insertion. One-inch minimum space accepted. **Classified Section:** Rates for classified advertising are 5 cents for each word including heading and address. Count seven words for keyed address. Minimum $1.00 for each insertion. Cash must accompany order.

Index to Advertisers

Firms represented in this issue are identified by the folio of the page on which their advertising appears. Advertising which appears in other issues is marked with an asterisk.

July, 1938

Acme Electric Welder Co..... 97
Advance Appliance Co..... *
Aerofin Corp. ..... *
Air Controls, Inc..... 85
Aldrich Co. ..... *
Allen Corp. 93
American Air Filter Co., Inc... *
American Brass Co. 19
American Rolling Mill Co., The 21
American Warming & Ventilating Co. 89
Anthracite Industries, Inc..... 6
Atcheson Glass Co., T. J.....100
Auer Register Co..... 75
Automatic Humidifier Co. 92
Automatic Products Co. ..... *

Barber-Colman Co. ..... *
Barber Gas Burner Co., The... 99
Bead Chain Mfg. Co..... 87
Berger Bros. Co..... 95
Beverly Throatless Shear Co...100
Binkley Mfg. Co..... *
Brauer Supply Co., A. G..... 97
Bremil Mfg. Co..... 97
Breuer Electric Mfg. Co..... 98
Buffalo Forge Co.....
.....Inside Back Cover
Burt Mfg. Co..... *

Century Electric Co. 65
Century Enginering Corp. 94
Chalmers Oil Burner Co..... *
Chandler Co. 87
Clarage Fan Co..... 96
Conco-Sampsel Stoker Corp.... 77
Condensation Engineering Corp.100
Congress Tool & Die Co..... 97
Cook Electric Co..... 80
Crescent Tool Co..... 18
Curtis Refrigerating Machine Co. 83

Dail Steel Products Co..... 87
Detroit Lubricator Co..... *
DeWitt Hotels 88
Dreis & Krump Mfg. Co..... 97

Eckenroth Register Co..... *
Eisler Engineering Co.....100
Electric Vacuum Cleaner Co., Inc. 87
Elgo Shutter & Mfg. Co..... 97
Excelsior Steel Furnace Co..... 94

Farrell-Cheek Steel Co..... 83
Fitzgibbons Boiler Co., Inc.... 10
Furblo Co. 89

G & O Mfg. Co., The..... 89
General Electric Co..... 17

Gleason-Avery, Inc. 96
Goese Mfg. Co..... *
Grand Rapids Furnace Cleaner Co. 94
Gray, G. L..... 94

Halectric Laboratory 100
Harrington & King Perforating Co. 89
Hart & Cooley Mfg. Co..... 91
Henry Furnace & Foundry Co., The .....85 and 91
Hess Warming & Ventilating Co. 78
"Home Comfort" Furnace & Mfg. Co. ..... *
Homer Furnace & Foundry Corp. 98
Hussey & Co., C. G..... 12

Illinois Testing Lab., Inc..... 98
Independent Register Co., The. 14
International Nickel Co., Inc... 5
Interstate Machinery Co.....100

Johnson Co., S. T..... *
Johnson Gas Appliance Co..... 94

Kent Co., The..... 97
Kol-Master Corp. 88

Lamneck Products, Inc.....
.....Inside Front Cover
Langsenkamp Co., F. H.....100
Lau Blower Co..... 78
Libert Machine Co..... *
Lincoln Electric Co..... *
Lochinvar Corp. 74
Lyon-Conklin & Co..... 99

Maid-O'-Mist Inc. 81
Majestic Co., The..... *
Malleable Iron Fittings Co.... *
Maplewood Machinery Co.....101
Marley Co., The..... 90
Marshalltown Mfg. Co..... 99
Maurey Mfg. Co..... 90
Meyer & Bro. Co., F..... 13
Meyer Furnace Co..... *
Michigan Tank & Furnace Co. *
Milcor Steel Co.....
.....Outside Back Cover
Minneapolis-Honeywell Regulator Co. 20
Monmouth Products Co..... 95
Morency-Van Buren Div., Scovill Mfg. Co..... *

National Super Service Co., The 92
Niagara Machine & Tool Works 81

Osborn Co., J. M. & L. A..... 66
Owens-Illinois Glass Co..... 11

Pacific Gas Radiator Co..... 93
Par Appliances, Inc..... 99
Peck, Stow & Wilcox Co..... *
Peerless Electric Co..... 91
Peerless Foundry Co..... 99
Penn Electric Switch Co..... 79
Perfection Stove Co..... 9
Premier Division, Electric Vacuum Cleaner Co., Inc..... 87
Pyrolite Products Co..... 99

Randall Graphite Products Corp. 88
Refrigeration and Air Conditioning Institute 95
Register & Grille Mfg. Co..... 98
Republic Steel Corp..... 22
Rock Island Register Co..... 93
Ruby Chemical Co..... *
Rybolt Heater Co..... 82
Ryerson & Son, Inc., Joseph T. 3

Sall Mountain Co..... 95
Schaefer Brush Mfg. Co..... 99
Scovill Mfg. Co..... *
Skilsaw, Inc. ..... *
Skuttle Humidifier Co., J. L... 76
Superior Sheet Steel Co..... *
Swartwout Co., The..... 84

Trane Co., The..... 44
Tuttle & Bailey, Inc..... 86
Twentieth Century Heating & Ventilating Co. 97

U. S. Air Conditioning Corp.... 99
U. S. Register Co. 7
U. S. Steel Corp. 15

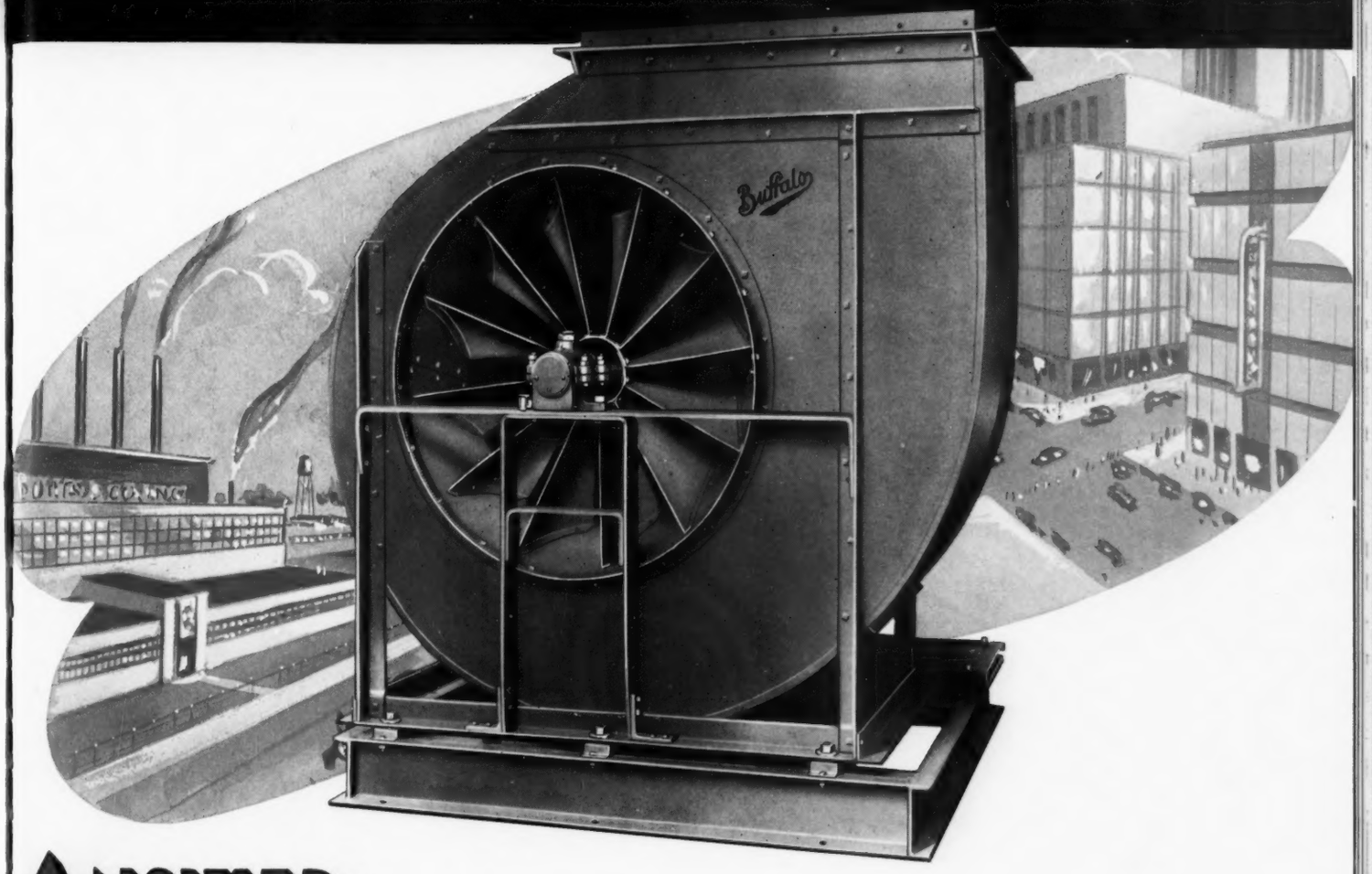
Voorhees, G. A.....100

Ward Machinery Co..... *
Waterloo Register Co..... *
Weil Pump Co.....101
White Mfg. Co..... 93
Whitney Mfg. Co., W. A..... 91
Whitney Metal Tool Co..... 8
Williamson Heater Co..... *
Wise Furnace Co..... *
Wiss & Sons Co., J..... 98
Wodack Elec. Tool Corp.....101

XXth Century Heating & Ventilating Co. 97

Youngstown Sheet & Tube Co. 16

QUESTION: *What* FANS *are* BEST *for those* BIG COMMERCIAL *and* INDUSTRIAL VENTILATING JOBS?



ANSWER:

"Buffalo" Limit-Load (REG. U.S.) Conoidal Fans (PAT. OFF.) *with* Silent Floating Bases

HERE'S WHY:

—Quiet in operation because of better blade design, rubber base mountings.

—Non-overloading—cannot overload and burn out motor regardless of amount of air delivered.

—Certified ratings.

—Statically and dynamically balanced.

—Backed by a company whose 60 year record for building better fans is well known to heating and ventilating engineers everywhere.

Write today for Bulletin 3099.

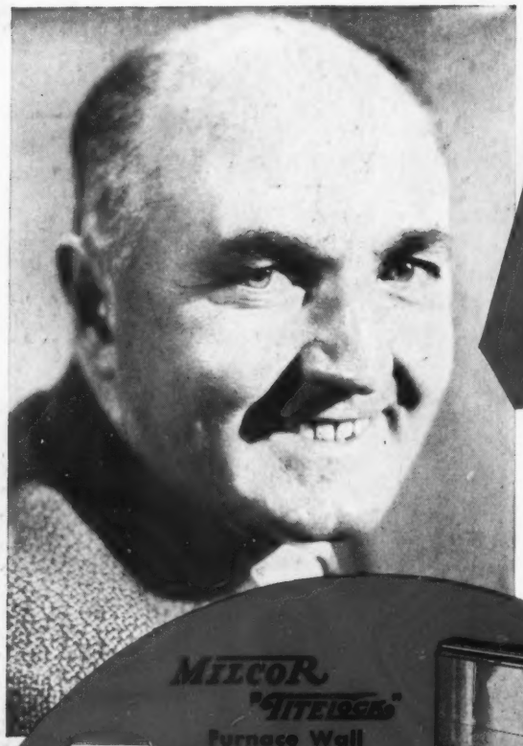
BUFFALO FORGE COMPANY

497 BROADWAY, BUFFALO, N. Y.

Branch Engineering Offices in Principal Cities

IN CANADA: CANADIAN BLOWER & FORGE CO., LTD., KITCHENER, ONT.

You and your customers both *come out ahead* with MILCOR Furnace Wall Stack and Fittings



MILCOR prompt service and dependable products help make every job profitable

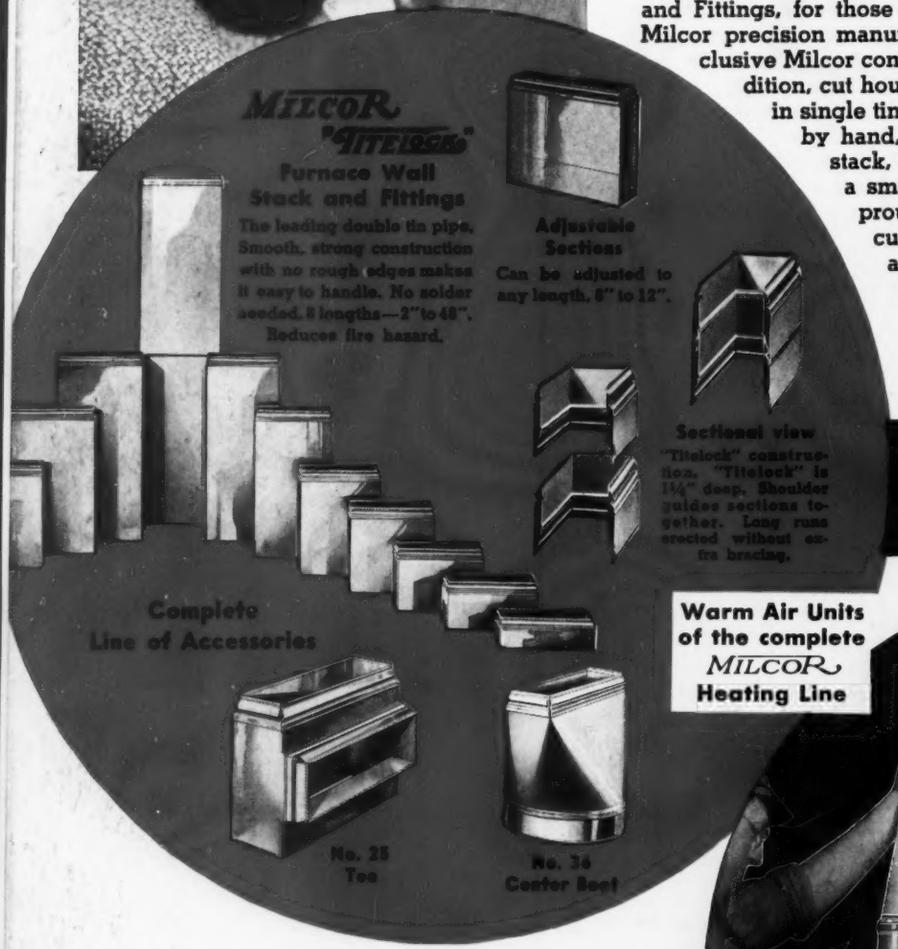
You come out ahead on the jobs you do with Milcor Furnace Wall Stack and Fittings, for those jobs are smoother, faster, *more profitable*. With Milcor precision manufacture you don't run into any "snags." And exclusive Milcor construction features, plus accessories to fit every condition, cut hours from assembly time . . . The "LockJoint" feature in single tin makes tools unnecessary. You assemble it quickly by hand, both long way and end way. In the double tin stack, the "Titelock" fits sections together rigidly, makes a smooth, easy job . . . Milcor gives you a job you're proud of — a job that leads to more jobs as satisfied customers tell their friends . . . Five big Milcor plants are ready to ship your order without delay. So profit by the experience of money-making shops everywhere — concentrate now on Milcor Wall Stack and Fittings. Check your Milcor Price List and see the new 1938 catalog. If you haven't a copy, write for one today.

H-1

MILCOR STEEL COMPANY

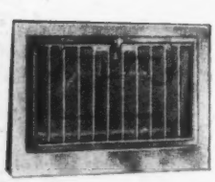
MILWAUKEE, WISCONSIN — CANTON, OHIO

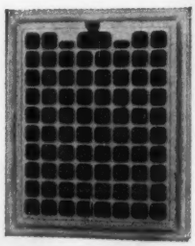
Chicago, Ill. — Kansas City, Mo. — La Crosse, Wis.


MILCOR "TITELOCK"
Furnace Wall Stack and Fittings
The leading double tin pipe. Smooth, strong construction with no rough edges makes it easy to handle. No solder needed. 8 lengths—2" to 48". Reduces fire hazard.
Adjustable Sections
Can be adjusted to any length, 6" to 12".
Sectional view
"Titelock" construction. "Titelock" is 1¼" deep. Shoulder guides sections together. Long runs erected without extra bracing.
Complete Line of Accessories
No. 25 Tee
No. 36 Center Boot

Warm Air Units of the complete MILCOR Heating Line

LOCK JOINT
(Patent No. 2,038,389)
Single Tin Wall Stack and Fittings
Assembled by pressing tongue into locking seam and turning notched ends over. End lock made by pressing bead into lock. No tools needed.
Each length shipped in two pieces, completely nested, saving storage space and room on truck.
Universal Boot
First Floor Baseboard Head
Complete Line of Accessories



H & C Baseboard Register
Attractive removable face. Smooth action.

H & C Sidewall Register
Heavy, corrugated fretwork. Positive, quiet operation.